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STRAIN INVESTIGATION OF GRASSES AND CLOVERS.

(Continued.)

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4. WHITE CLOVER (*Trifolium repens*).

For permanent grasslands in temperate climates the world over white clover ranks potentially as the most important of all legumes. The presence of a legume in the pasture ideal is essential. The clovers are good mineral catchers, for, in addition to being rich in protein, they are also rich in lime and phosphate. It is generally conceded that a grass plus clover ration is a more balanced stock-food than is either grass or clover alone. The presence of clover in the grazing sward has a beneficial effect upon the healthy development and producing capacity of the grasses growing in association with it, and also increases the palatability of the pasture as a whole. Within that range of habitat conditions which makes high-production pastures possible, white clover stands out as the ideal legume—ideal in the sense of being high-producing, of high mineral content, easy of management, and blending well in the pasture association.

White clover sets a standard of excellence the attainment of which should be the aim of every permanent-grassland farmer. Its presence in a mixed well-balanced sward is indicative of ideal growing conditions and perfection in management. The nearer one gets to perfection in fertility upkeep—manuring in all its phases; in drainage or soil-moisture conservation, and in management and utilization of the herbage—the better is the blending of white clover and associate grasses. Too much white clover in the pasture bespeaks faulty construction or faulty management of the sward. White clover is an aggressive species within its habitat range, and from its lateral

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spread by means of stolons it is capable of filling up bare spaces consequent upon poor establishment or weakening and running-out of associate species. Close and continuous grazing, or close clipping of sward with lawn-mower, may damage and weaken the erect growers and tufted associate grasses, and against these weakened plants white clover, whose runners and growing points are undamaged, makes rapid headway. We regard as our ideal 30 to 40 per cent. of clover and 60 to 70 per cent. of grass. More than 40 per cent. of white clover in the pasture would indicate (1) poor construction of the original sward, (2) use of inferior grass strains that do not persist, or (3) mismanagement of the pasture in heavy hay-production that smothers, causing the formation of a weak turf, or too close and continuous grazing that weakens the associate species, and thus affords bare ground into which white clover may rapidly spread.

This running to white clover dominant is a common feature of grasslands in New Zealand. One sees it on hill country as a temporary phase in the decline of soil-fertility and running-out of the more or less temporary elements that are sown; on arable land following on the cereal crop; in the permanent grasslands as defects at sowing, in choice of species and strains, in choice of unbalanced manurial top-dressing materials, and in faulty management generally. All this but stresses the aggressive nature of white clover, and serves to place on this species a value not possessed by any other clover for permanent pasture work.

Within a species so world-widely utilized in and out of its own special environment it is to be expected that strain differences exist, and the immediate purport of this article is to set out the result of our trials in New Zealand as far as these have gone to date. Realizing the intrinsic value to world grasslands of white clover, any improvement in type must reflect added wealth from the pastures of this country and stimulate a keener demand from overseas for the surplus seed that is annually harvested and exported from New Zealand. Further, the use of decidedly inferior strains that abound on the markets to-day must tend towards failure or partial failure of white clover in the pasture, with subsequent reduced yields.

In regard to strain studies and the application of white clover types in grassland we are definitely keeping in view four main possibilities: (1) The provision of a highly productive, persistent, long-seasonal-growth form—particularly a winter grower—for first-class and potentially first-class country; (2) the adaptation of a permanent white clover type to soils lower in plant foods than normally required by white clover—*i.e.*, whether it is possible by strain selection to widen the habitat range for white clover so as to include soils considered at the present time too poor for it to thrive in; (3) determination and type value of that white clover in annual cropping areas, the perpetuation of which we consider is by annual reseeding and re-establishment from seed shed. Here are three habitats for occupation by white clover essentially distinct the one from the other, and what has to be determined is whether the one strain of white clover is equally valuable on all three types, or whether it must be recognized that each particular major ecological condition

calls for a different strain of white clover. There is, fourthly, the requirements of export markets to consider. At the present time it would seem that Britain offers quite large possibilities as a market in which the trade in New-Zealand-grown white clover could be extended. It is therefore incumbent upon local research to co-operate with grassland research centres in Britain, with the object of finding out exactly how selected types of New Zealand white clover behave in the Mother-country, and if any of these are an outstanding success to reproduce those types specifically for export to Britain.

Great Britain certainly offers a valuable market for white clover seed. According to Williams* that country used 500 to 600 tons in 1928. The bulk of this quantity was imported largely from northern Europe, while New Zealand only supplied 20 to 25 tons in that year. It is fairly established in Britain that Kentish Wild White clover as a type is eminently suited to their conditions, and there is a good deal of evidence to indicate that some of the New Zealand types may have a very definite sphere of usefulness in British grasslands. Comparative tests are being undertaken by the Welsh Plant Breeding Station and certain other centres in Britain in co-operation with the Plant Research Station at Palmerston North, and it is extremely likely that the New Zealand white clover strain position may be clarified very rapidly.

The problem in strain analysis is to decide, on the basis of accurate experiment, which types are best suited to the particular purposes in view, to study the relative production capacity of the types, their persistency and their ability to withstand grazing on the one hand and the competition of other plants of the sward (as under ensilage or hay) on the other, and then to isolate and perpetuate those types or a mixture of types best fitted to fulfil the requirements.

MAJOR TYPES OF WHITE CLOVER.

From data to hand as a result of our trials during the past two years white clover in general shows extraordinary variation in type, and the differences shown have a definite relationship to the economic usefulness of the types. There are six major types, which are here briefly outlined and described.

Type 1: New Zealand Wild White No. 1.—A large-leaved, widely spreading, stout-stoloned, highly productive type met with in New-Zealand-grown samples. It establishes very rapidly from seed, bears leaves many times the size of ordinary forms, makes fairly dense and tall growth, and appears to be reasonably persistent. Clearly an outstanding type that has stood well above ordinary white clover in total production and in seasonal spread of that production. Type plants are shown in Figs. 1 and 2. This growth-form is fairly common in commercial lines of New Zealand seed, but, while only small traces occur in the majority of samples containing it, a few lines are dominantly of this type.

Type 2: New Zealand Wild White No. 2.—Figs. 3 and 4 show type plants. The leaves are much smaller than in the Type 1 group, the runners are more slender, and the plants themselves are denser and

* R. D. WILLIAMS: "Comparative Agronomic Values of Red and White Clovers of different Origin. *Jour. Irish Dept. Agric.*, Vol. 28 (1), 1929.

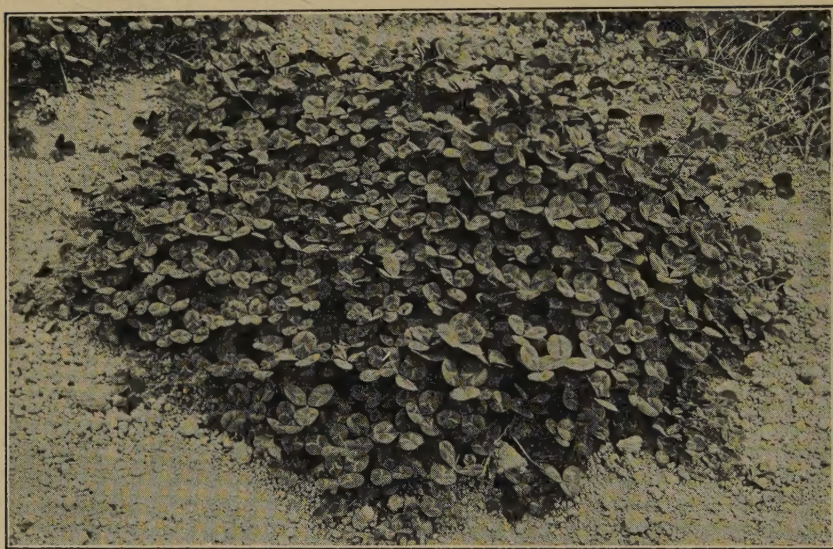


FIG. 1. NEW ZEALAND WILD WHITE CLOVER NO. 1.

Single plant, six months old, showing typical summer growth on 4th March, 1930. Large-leaved, tall-growing, fairly dense, absence of flower in first year after sowing.



FIG. 2. NEW ZEALAND WILD WHITE NO. 1.

Same single plant as in Fig. 1. Nine months old, showing good winter growth, 28th June, 1930.

[Photos by H. Drake.

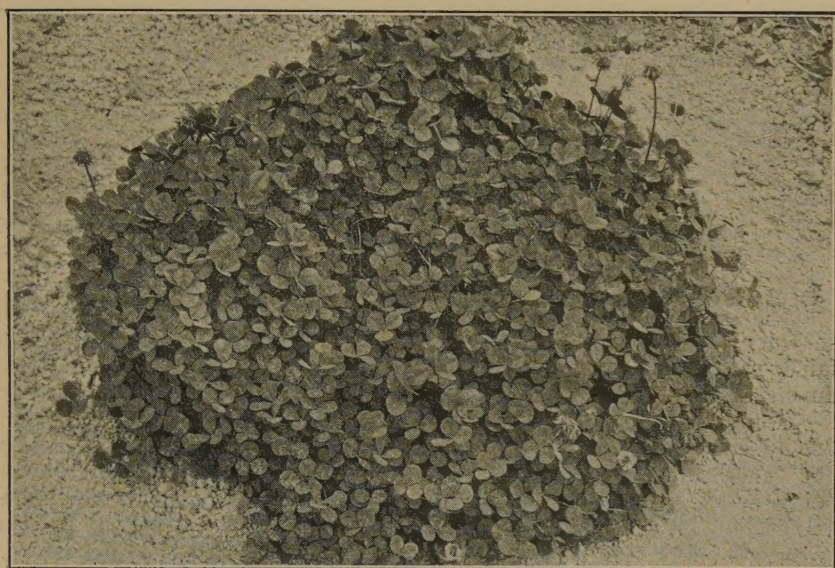


FIG. 3. NEW ZEALAND WILD WHITE NO. 2.

Single plant, six months old, showing typical summer growth, 4th March, 1930. Moderately large-leaved, dense growth, sparse flowering in first year after sowing.



FIG. 4. NEW ZEALAND WILD WHITE NO. 2.

Same single plant as in Fig. 3. Nine months old, showing moderately good winter growth, 28th June, 1930.

[Photos by H. Drake.]

produce a more compact cushion, particularly in the summer. Establishment from seed is less rapid than in the large-leaved Type 1 forms, and in the period covered by our critical trials production was lower. This type is fairly common in old-pasture seed from the Hawke's Bay District, and traces of it occur in lines originating from other districts in New Zealand. Neither the No. 1 nor No. 2 type flowers to any appreciable extent during the year of sowing. They normally flower about a month to five weeks later than ordinary imported white clover, and appear to flower and seed quite abundantly in their second year (Fig. 13). In our trials they flowered rather earlier than the densest and most productive types in Kentish Wild White clover.

Type 3: Ordinary New Zealand white.—The average type is shown in Figs. 5 and 6. It establishes fairly rapidly from seed and is fairly productive during the first summer, but not nearly so productive during that period as New Zealand Wild White. It flowers abundantly in the first summer after sowing, and normally very early in the season. Leaves are of medium size. This type is a poor winter grower, and does not persist for more than two years, its production in the second season being low. Plants of this conformation are common in the make-up of ordinary imported white clover, but those in New Zealand lines appear to be rather more vigorous and possibly slightly more persistent. This is probably due to the intercrossing of the ordinary imported type with the more productive and permanent New Zealand Wild White (Types 1 and 2 discussed above).

Type 4: Lax early-flowering New Zealand and ordinary European white.—This type is shown in Figs. 7 and 8. It represents the least persistent as well as the least productive group of white clovers. The type establishes rapidly from seed, after which it has a short vegetative period and then goes straight to seed. The photograph shown in Fig. 7 was taken when the plant was four months old, and it will be seen that most of the seed-heads are dead ripe, while the total amount of leafy produce is negligible in comparison with the New Zealand Wild White types. (Compare Fig. 7 with Fig. 1.) The leaves are small, and the type never shows great vigour. After the seed is ripened the plant becomes practically dormant, and a very large proportion of the plants fail to overwinter the first season. The type may be regarded practically as an annual; it is the most common form in ordinary imported white clover, and represents the type of least economic value to the New Zealand grassland farmer.

Type 5: Kentish Wild White.—The most dense type of plants found in Kentish Wild White in our trials is represented by Figs. 9 and 10. The average type is dense, small-leaved, and inclining to form a dense mat of close-growing herbage. As a type it establishes but slowly from seed, and is very susceptible to competition from its associates in the pasture during this period. Its production is low during the year of sowing, and it does not flower until the second spring, when it blooms rather later than New Zealand Wild White and much later than the ordinary commercial forms of white clover. Under New Zealand conditions it is winter dormant relative to New Zealand Wild White, and does not at any period during the first two or three years equal the latter in rapidity of growth. Kentish Wild White is particularly a permanent form of white clover under pasture conditions, especially where competition from tall-growing plants is not excessive.



FIG. 5. ORDINARY NEW ZEALAND WHITE CLOVER.

Single plant, six months' old, showing typical summer growth, 4th March, 1930. Free-flowering in first year after sowing.

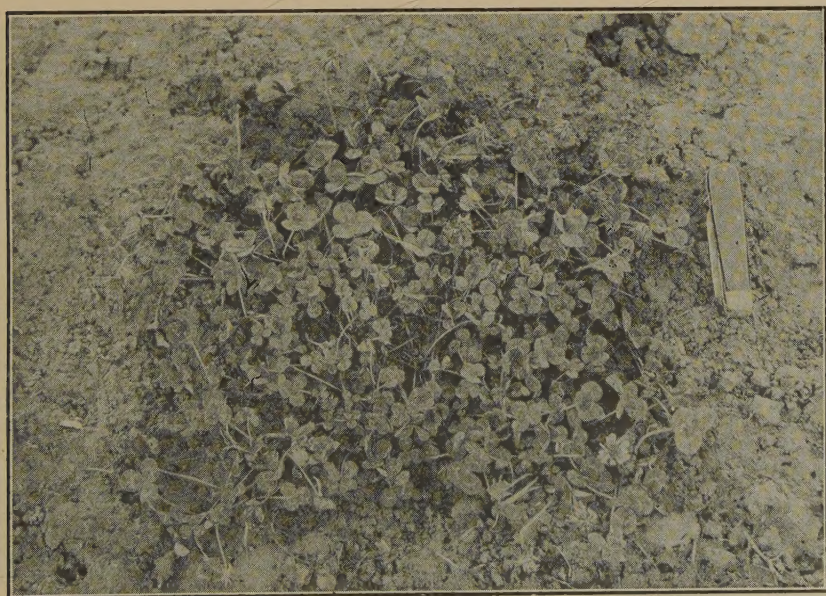


FIG. 6. ORDINARY NEW ZEALAND WHITE CLOVER.

Same single plant as in Fig. 5. Nine months old, 28th June, 1930, showing moderately poor winter growth.

[Photos by H. Drake.]

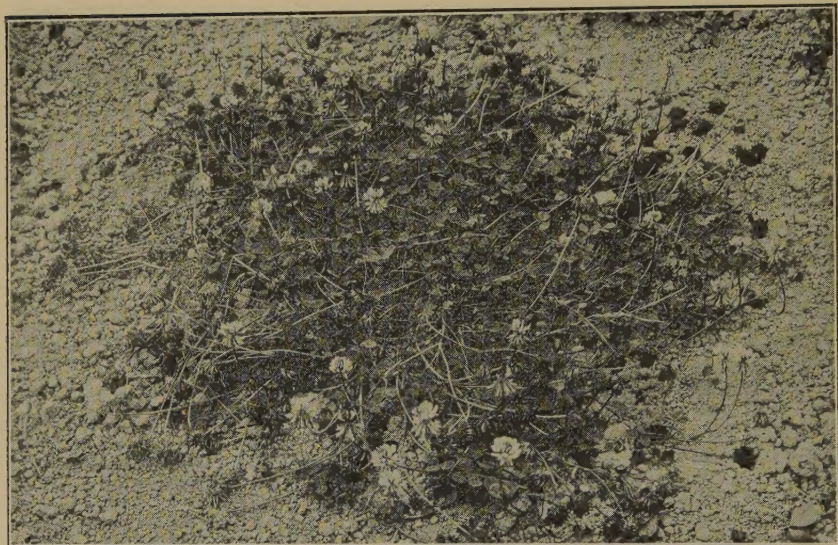


FIG. 7. POOR NEW ZEALAND AND NORMAL IMPORTED WHITE CLOVER TYPE.

Single plant, six months old, showing quick-maturing and free-seeding habit, 4th March, 1930. Practically no summer growth made by this type subsequent to this date.

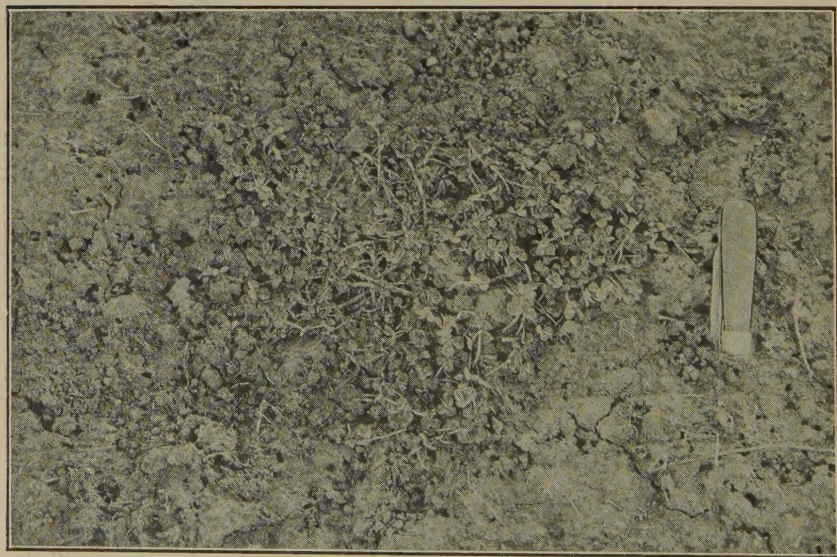


FIG. 8. POOR NEW ZEALAND AND NORMAL IMPORTED WHITE CLOVER TYPE.

Same single plant as in Fig. 7. Nine months old, showing dormant winter growth, 28th June, 1930, and virtual death of plant.

[Photos by H. Drake.]

Type 6: Ladino white.—This type is generally associated with Northern Italy. It is probably the tallest-growing and largest-leaved white clover in commerce. The plant is extremely lax in growth, and makes very rapid lateral spread by means of its long stout stolons. Under New Zealand conditions it establishes readily from seed, makes rapid seedling growth, and does not flower in the first season. Under hay conditions it has persisted well, but never gives a dense cover; when mown frequently it proved one of the least persistent types of white clover in our trials, going out completely under weekly mowing in less than twelve months. In many ways the Italian Ladino type seems to be related to the large-leaved New Zealand Wild White No. 1, but in economic value the two are quite distinct. The New Zealand form is more dense, more productive, more persistent, and altogether the more valuable pasture type.

ECOLOGICAL CONDITIONS.

In regard to application of the foregoing types of white clover in world grasslands, we feel certain that whether the seed is to be used locally or overseas the same type will hold good for the same set of ecological conditions. The first-class dairying pastures for the most part claim the best grassland soil-types the world over. High production, together with inevitable strong competition among the members of the sward, hay and ensilage production as a feature, and long grazing grass rather than short, characterize such pastures in New Zealand at least. To our mind the white clover types that ideally suit the dairy pasture are New Zealand Wild White No. 1 and No. 2. No. 1 is an outstanding type that should command attention wherever high-production permanent grasslands rule or are the aim. During our period of trial it has stood well above ordinary white clover in total production and in seasonal spread of that production. In New Zealand this type normally occupies the most favoured grassland areas in both Islands, where it may occur either as a pure stand or as an important member of the sward. At the present time definite areas are being located and mapped, and as this is done the certification scheme already in vogue in New Zealand will be applied. Thus within a few years pure lines of New Zealand Wild White No. 1 should be available for distribution.

New Zealand Wild White No. 2 is also an excellent type, and compares almost equally with No. 1. It is slightly lower in production, smaller in the leaf, and poorer in winter growth, but it is an excellent clover that may be used to advantage in all good average grassland soils. A mixture of New Zealand Wild White No. 1 and No. 2 should give excellent results. From an export trade point of view we are now definitely of the opinion that these two types are wholly responsible for the good name associated with New Zealand white clover in Great Britain. New Zealand white clover on the English market has a mixed reputation, and looking over our trials the explanation is not difficult to find. The average New Zealand white of commerce is a mixed lot, and we have now definitely an indication of the types that have enhanced this Dominion's name for white clover overseas, and of those types that are prejudicing our trade. Further, we have evidence to show that New Zealand Wild White No. 1 is behaving in Britain in like manner to its behaviour here, and it is probable that New Zealand Wild White No. 1 is not excelled in production combined with persistency by any other commercial white clover in the world.

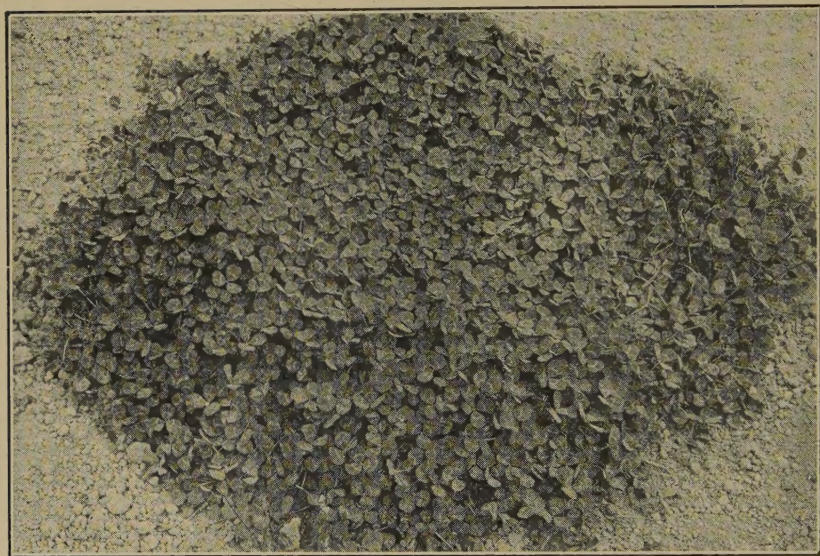


FIG. 9. KENTISH WILD WHITE.

Single plant, six months old, showing summer growth, 4th March, 1930. Small-leaved, dense compact habit, with absence of flower in first year after sowing.



FIG. 10. KENTISH WILD WHITE.

Same single plant as in Fig. 9. Nine months old, showing winter growth, 28th June, 1930.

[Photos by H. Drake.]

Ladino white clover looks like an overgrown New Zealand Wild White No. 1. Its sphere of usefulness is limited to first-class country given over largely to temporary pastures or to pastures that are regularly hayed and lightly grazed between times. Its low persistency under normal grazing renders it unsuitable for permanent pasture work. In Britain the type behaves largely as an annual, and is there regarded as of no intrinsic value.

The ideal type of white clover for second-class and poorer soils is more likely to be found approximating to the Kentish Wild White type and New Zealand Wild White No. 2. Kentish Wild White in New Zealand in comparison with New Zealand Wild White No. 1 and No. 2 has on the first-class soil-types given very disappointing results in both single-plant and broadcast plot trials. Kentish Wild White fails as a competitor under first-class pasture production conditions in New Zealand, and is swamped by the rank grass or other volunteer growth, particularly during the winter and early spring, when Kentish Wild White is more or less dormant. Again, its relative slowness to establish militates against its usefulness in high-class grassland. As a persistent type there is possibly nothing to equal Kentish Wild White, but in order to keep pace with strong competition, particularly under ensilage and hay production, only a high-production and highly aggressive type of white clover can be of value. There may be just the danger in present-day herbage-plant breeding to sacrifice production for leafiness and persistency, but where one is dealing with high-production grasslands with their intense competition, particularly in the lower story, one is bound to look for a white clover type that can stand up to these conditions and yet retain its capacity for growth and aggressiveness.

Kentish Wild White as a type appears excellently suited for sheep pasture rather than cattle pasture, and for those soils somewhat below the fertility standard for high-production types of white clover. In other words, if the habitat range of white clover is to be extended, we feel certain that the Kentish Wild White type is more likely to effect this than any other type yet met with in our white clover type studies. In advocating the use, however, of a low-production strain, we feel we should impress rather the desirability of making every effort to improve soil conditions to the point that high-production strains may thrive, rather than accept low-production strains to fit the impoverished soil conditions as they exist at the moment. The place in New Zealand grasslands where one would expect to use the Kentish Wild White type to the greatest advantage is on the brown-top soils; during the initial phases of bringing in the great areas now carrying brown-top (*Agrostis tenuis*) into profitable dairying and ewe pastures, and as a perennial clover under sheep-farming generally, Kentish Wild White can be of great value.

Kentish Wild White is not recommended for the potentially high-production dairy pastures in New Zealand, and every effort should be made to introduce as early as possible New Zealand Wild White No. 1 or No. 2.

The third ecological condition under which white clover figures as an important constituent of pasture in New Zealand is under arable and short-rotation farming—arable and short-rotation of necessity due



FIG. 11. NEW ZEALAND WILD WHITE NO. 1 (LEFT) COMPARED WITH POOR NEW ZEALAND WHITE CLOVER TYPE (RIGHT) IN SUMMER.
(Compare with Figs. 12 and 13.)



FIG. 12. NEW ZEALAND WILD WHITE NO. 1 (LEFT) COMPARED WITH POOR NEW ZEALAND WHITE CLOVER TYPE (RIGHT) IN WINTER.
(Compare with Figs. 11 and 13.) [Photos by H. Drake.

to unfavourable climatic conditions for high-production permanent grassland. In belts of low seasonal rainfall the permanent-pasture condition does not permit of absorption and conservation of what rain falls to anything like the extent that arable land does. The basic principle in farming under low seasonal rainfall is to so prepare the land and cultivate it that it readily absorbs and retains for as long as possible the maximum of moisture, and to employ a rapid-growing and quick-maturing crop that makes full use of the moisture absorbed, and which ripens and sheds its seed before the supply of moisture in the soil is exhausted. Under such conditions as this a white clover to be effective must very closely approximate the annual, and our



FIG. 13. NEW ZEALAND WILD WHITE NO. 1 (LEFT) COMPARED WITH POOR NEW ZEALAND WHITE CLOVER TYPE (RIGHT) IN SPRING.

Note in this view the abundant flowering of New Zealand Wild White No. 1 in second year. (Compare with Figs. 11 and 12.) [Photo by H. Drake.

study of white clover types has brought out this fact very clearly. Virtually the whole of the volunteer and stubble white of arable Canterbury is of the early-flowering, free-seeding, quick-maturing annual type. It is in effect very little better than European white clover, which in New Zealand and in Britain is for all practical purposes an annual clover.

These annual forms of white clover, ecologically no doubt have a place in world grassland. Their perpetuation depends almost entirely upon re-establishment from seed shed each year, and their seasonal growth is determined largely by the soil conditions ruling at the time of establishment. Where the land has been cultivated and sown to a cereal or other annual crop conditions are propitious for good establishment, and for some time subsequent to the removal of the sown crop the effect of cultivation persists and good crops of clover are

secured. As the soil consolidates, however, re-establishment from seed becomes more and more difficult, and poorer and poorer growth results, until the ground is again broken up by the plough. We have on record certain of these types having persisted and produced a harvestable seed-crop after five years down, but it is also very noticeable that these five-year and older crops show in the main a decided improvement in type over those harvested in the first or second year down. Howbeit, none approaches in productivity and vigour those lots which we here term New Zealand Wild White No. 1 and No. 2.

PRACTICAL USE OF THE INFORMATION.

The main point at issue, having discovered that marked variation in type exists in New Zealand white clover and that these types conform to definite habitats (Table 3*), is what practical steps should be taken to make the best possible use of this information. We do not propose to condemn any type—each type, it would appear, has a specific purpose; the problem is to allocate each type to its sphere of usefulness in the sown grasslands of the world, and to take measures to prevent the wrong types being used for any specific purpose in view. For the truly permanent high-production grasslands of New Zealand, Great Britain, and other overseas countries our seal should be firmly set on the types we are here calling New Zealand Wild White No. 1 and No. 2, and every effort by the New Zealand Department of Agriculture and by the trade should be made to earmark these types for this specific purpose. Kentish Wild White fills a definite role, in our opinion, on soils of poorer quality—dominant brown-top soil-type—and is more useful under sheep-farming than under dairying. The third type at best should only be employed in the grasslands of the arable-farming belt of the world where high or moderately high-production permanent grasslands are an impossibility.

These recommendations are made in the light of the knowledge we at present possess, and they are made with the assurance that as higher and higher production becomes possible through adequate feeding of grasslands so will the demand for New Zealand Wild White No. 1 and No. 2 types increase.

The question of blends of these different types of white clover will naturally arise—whether in view of the small supply of New Zealand Wild White No. 1 and No. 2 it would not be possible to blend a certain percentage of this along with the major free-seeding annually-inclined type. Many lines in practice are a mixture of types, and as such are very much better than pure lines of the annual types. In our trial grounds at Palmerston North, after twelve months and into the second year, there is a decided change in the relative composition of the clover plots so far as white clover types are concerned, and in each case the change is from the smaller-leaved annual types to the larger-leaved New Zealand Wild White No. 1 and No. 2 types. The No. 1 type is outstanding in this respect. Quite a small percentage of New Zealand Wild White No. 1 in the original plot will soon lead to dominance on that plot of this type. This in itself is very significant for the soil-type where our trial grounds are situated—that is, on first-class river alluvial silt. However, on quite second-class country—improved brown-top soil-type—New Zealand Wild White No. 1 has

* In second part of article.

since sowing down in 1926 become increasingly dominant. It will, of course, be quite impossible to determine for the trade the percentage of each type in a blend unless single-plant trials are conducted of the line, but we are strongly of the opinion that New Zealand white clover as a whole would command a much better name on the overseas market did all seed exported contain even a small percentage of the No. 1 and No. 2 New Zealand Wild White types.

Two courses then are open to the trade: (1) To earmark a limited supply only of New Zealand Wild White No. 1 and No. 2, and to put this on the market under certification as a special élite strain; or (2) to blend supplies of New Zealand Wild White No. 1 and No. 2 with the general crop and put this blend on the market as New Zealand white clover, gradually improving the standard as the percentage of Wild White No. 1 and No. 2 increases. We do not recommend the latter procedure except as a purely temporary measure until supplies of the best types become available in adequate amount.

(To be concluded next month: The second part of the article will give an account of white clover trials at the Plant Research Station.)

EFFECT OF AMMONIUM SULPHATE ON FIELD GERMINATION OF RAPE AND TURNIPS.

Fields Division.

A LARGE amount of experimental evidence has been gained on the adverse effect of superphosphate on the germination of cruciferous crops when the manure is sown in direct contact with the seed. It has been shown (1) that in areas of low summer rainfall, unless an appreciable amount of rain falls immediately after sowing, 1 cwt. super with turnip-seed is sufficient to injure germination to a considerable extent. The causes of this germination injury have been discussed in this *Journal* (A. W. Hudson, October, 1928) and attributed to the fact that super, being a highly soluble fertilizer, brings about plasmolysis of the seed in the absence of a sufficient supply of moisture. Rock phosphates, or super mixed with an equal quantity of carbonate of lime a few days prior to sowing, have no such effect on the seed.

An investigation into the effect on germination of other soluble fertilizers, such as sulphate of ammonia, was commenced in the 1929-30 season. Small plots were laid down in duplicate adjacent to the main manurial trials on five turnip experiments and four rape experiments. Treatments consisted of (1) super 1 cwt. per acre; (2) super 1 cwt., plus sulphate of ammonia 1 cwt., per acre; (3) super 1 cwt., plus lime (carbonate) 1 cwt., plus sulphate of ammonia 1 cwt., per acre. The manure was sown with the seed in 14 in. rows.

In all cases the sulphate of ammonia had a very injurious effect on germination, and in three of the experiments plants were so few that it was not considered worth while taking germination counts. The results of those experiments on which germination counts were taken are summarized in the accompanying table, and it will be seen that

germination has been considerably depressed when sulphate of ammonia was used both with super and with super plus lime.

Table showing relative Field Germination on Differently Manured Plots, 1929-30 Season.

Super plus lime = 100.

Farm and Crop.	Super 1 cwt., plus Lime 1 cwt., per Acre.	Super 1 cwt. per Acre.	Super 1 cwt., plus Sulphate of Ammonia 1 cwt., per Acre.	Super 1 cwt., plus Lime 1 cwt., plus Sulphate of Ammonia 1 cwt., per Acre.
<i>Rape.</i>				
J. Syme, Darfield ..	100	66	25	29
J. Marshall, Hinds ..	100	89	13	10
F. N. Wright, Hororata ..	100	81	33	36
J. Fleming, Lismore ..	100	72	25	28
<i>Turnips.</i>				
A. J. Cleland, Sutherlands ..	..	100	24	44
H. Meyer, Hook ..	100	82	8	15

NOTE.—The germination figures of super 1 cwt. plus lime 1 cwt. are taken from the main trials alongside these experiments, and are used as the standard of comparison in order to give some idea of the actual depression in germination caused by sulphate of ammonia as distinct from that due to super alone.

In three of the experiments rain commenced falling almost as soon as drilling had finished, and in a further trial drilling was carried out after heavy rain the previous night. It would thus appear that injury occurs even under favourable conditions of soil-moisture.

Experiments conducted in South Africa by the African Explosive and Industries, Ltd., showed that germination injury to the seeds of cotton, peanuts, and maize was caused by sulphate of ammonia and also by nitrate of soda, at 50 lb. per acre in contact with the seed. The harmful results were avoided, however, when the fertilizers were applied two or three inches away from the seed. (*The Farmer's Weekly*, South Africa, 24th November, 1926.)

The smallest quantity of sulphate of ammonia which can be sown without injury to germination is probably so small that the fertilizer would have little effect on yield. If sulphate of ammonia is to be used on the turnip or rape crop it would appear necessary to apply it as a predrilling, or a post-drilling when the plants are established, or as a top-dressing at or some time after sowing. Experiments in Canterbury indicate that sulphate of ammonia predrilled causes no serious injury to the germination of turnips.

The field work in connection with the various experiments here summarized was carried out under the direction of Mr. R. McGillivray, Fields Superintendent, Christchurch, by Instructors E. M. Bates, W. C. Stafford, K. M. Montgomery, and G. G. Calder.

—J. W. Woodcock, Assistant Crop Experimentalist.

Average Production of Butterfat per Cow in New Zealand.—A carefully worked out estimate by the Dairy Division for 1929-30 gives New Zealand's average cow a butterfat production of 218 lb. This includes all cows in milk and dry.

MEDULLA IN WOOL.

NEW TEST FOR DETECTION OF HAIRINESS IN THE FLEECE.

B. L. ELPHICK, B.Sc., Assistant Lecturer in Chemistry, Massey Agricultural College, Palmerston North.

THE natural covering of nearly all mammals may be divided into two types of fibres, occurring separately or together. In the sheep's fleece the representatives of these types are wool and hair. Hair is distinguished from wool in that its fibres contain a central core of air-filled cells, called the medulla, while pure wool fibres contain no medulla.

There is every reason to believe that the ancestors of our present-day sheep possessed a considerable amount of hair in their fleeces, and that owing to the superior qualities of wool as a textile fibre the effect of long-continued selection and breeding has been to eliminate very largely the tendency toward the production of hair. That this process of elimination is not yet complete is evidenced by the presence in the fleece of kemps, thick hairy fibres, which are shed before they have attained much length; and perhaps also by the large proportion of hair found in some fleeces. In the Romney breed, with which the writer is at present concerned, the extraordinary wide variations in the nature of wools encountered suggests that the above-mentioned state of affairs is not altogether inevitable. It is not suggested, however, that these defects are confined to the Romney breed.

It is the object of this article to discuss briefly the economic significance of the presence of hair in the sheep's fleece, and to describe a simple new test by means of which small traces of hair may be distinguished from pure wool, and their amount estimated more effectively, cheaply, and rapidly than by any previous practicable method.

MEDULLA IN WOOL FIBRES.

The process of formation of the wool fibre or of the hair, as the case may be, takes place at the base of a depression, known as the follicle, in the outer layer of the skin. Here, the epidermal cells, of which the skin is formed, undergo changes which give rise to the fibre materials. One of the most important changes appears to be the absorption of the sulphur-containing substance, cystine, in some form, from the blood-stream of the animal, with the formation of the complex protein keratin, of which pure wool is mainly composed. The view has been expressed that it is the introduction of the sulphur contained in the cystine which is largely responsible for the elasticity of the fibre; and the incorporation of this sulphur, with the corresponding increase in elasticity, has been likened to the vulcanization of rubber.

It would appear that under some circumstances this process of keratinization is incomplete, only the outer cells of the fibre having become altered in this way. The core of the fibre then remains composed of unkeratinized epidermal cells, of a structure entirely different from that of the outer keratinized part of the fibre. This core is known as the medulla, and the medulla cells are usually filled with air.

The microphotographs shown in Fig. 1 serve to illustrate the different degrees to which fibres may be medullated. The portions

showing black are the medulla cells filled with air. Fig. 1 (*d*), kemp, shows clearly the difference in structure between the central medulla and the outer keratinized part of the fibre. In this case only part of the medulla is filled with air. The rest is filled with some liquid, and being thus made transparent its structure becomes more apparent.

Fibres containing a well-pronounced medulla are described as hair, in contrast to pure wool fibres which contain no medulla. The term "hair," however, is customarily applied only to those fibres in which the medullation is so pronounced as to lend a characteristic appearance to the naked eye. In such cases the silky translucent appearance of pure wool gives way to a chalky appearance. This is due to the light being reflected by the air contained in the medulla cells. The effect is exactly the same as that produced by minute gas bubbles in an effervescing liquid. Fibres containing only a thin and perhaps discontinuous medulla often cannot be distinguished from pure wool by

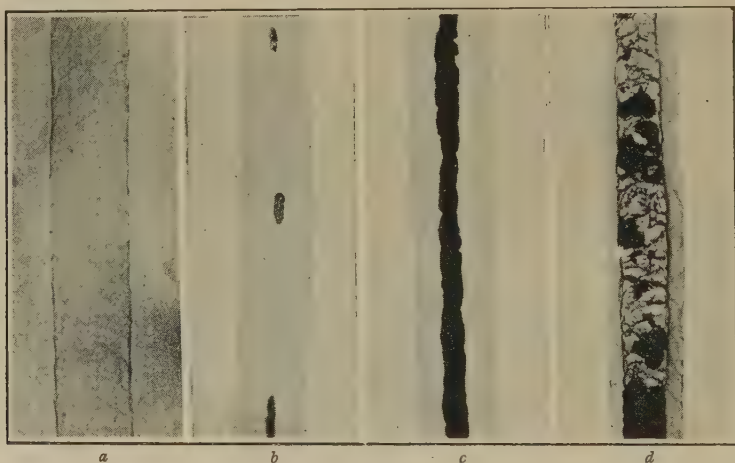


FIG. 1. MEDULLA IN WOOL FIBRES (MAGNIFIED APPROXIMATELY 200 TIMES).

(*a*) Non-medullated "pure" wool fibre (note scales); (*b*) fibre containing fine fragmentary medulla; (*c*) hair—fibre containing strong continuous medulla; (*d*) kemp—very strongly medullated fibre.

their appearance to the naked eye; and so it is doubtful if it is wise to invite confusion by applying the term hair to such fibres. In future, therefore, it is suggested that the term hair be used only to denote the more coarsely medullated fibres.

OBJECTIONS TO MEDULLA IN WOOL.

The presence of medulla considerably affects the physical properties of the fibre. The pure wool fibre is in many respects an ideal textile fibre, being possessed of remarkable strength, elasticity, and flexibility. Being coated with scales the fibres interlock and felt down* readily.

* Hair and wool fibres possess an outer layer of scales, which easily become interlocked, this being the main factor causing the fibres to cling together so readily. Thus in a woollen fabric the loose projecting ends of pure wool fibres lie down or "felt down," giving the fabric a smooth soft surface. The thicker, less flexible fibres, however, will not felt down so readily.

Further, the chemical nature of the keratin itself is such that the fibre readily absorbs a wide range of different dye materials.

Medullated fibres, on the other hand, are less elastic, less flexible, and, according to most available information, not so strong as pure wool fibres of the same diameter. They do not absorb dyes to the same extent. Being less flexible, they do not felt down so readily. Thus, for example, the fibres upstanding from a tweed are usually found to be hairy. Then it is complained that hairy fibres give very considerable trouble in the spinning of worsted yarns, since they will not bed down well, thus giving rise to weakness in the yarn and harshness in the worsted produced. Furthermore, medullated fibres are usually thicker and longer than the pure wool fibres with which they are associated in the fleece.

These differences are of extreme concern to the textile manufacturer. Small differences of strength, diameter, elasticity, &c., become very important when the fibres are taking part in the high-speed mechanical process. Thus it is said that a machine adjusted to deal with pure wool fibres of a given count is not, at the same time, adjusted in the manner most suitable for the coarser hairy fibres. The lack of uniformity in the raw material occasioned by the admixture in the fleece of hair and wool leads, therefore, to difficulties in manufacture, and also to the production of an inferior article. Another complaint is levelled against the extreme harshness of handle possessed by hair.

Now, it is important to bear in mind the difference between the points of view of the wool buyer and the manufacturer on the one hand and of the sheep-breeder on the other hand in regard to this question of medulla in wool. The buyer is concerned only with the immediate unalterable properties of the wool as exposed for sale; whereas to the breeder the fleece is full of potentiality.

Although no definite evidence is yet available in this country, it seems apparent that the trade is perfectly satisfied with wool so long as it does not contain strongly medullated fibre or hair (provided, of course, that its other qualities are satisfactory). One is presumably justified, therefore, in assuming that the trade draws the line at the point where the medulla becomes so pronounced that it is visible to the experienced naked eye.

The breeder is as much concerned with the immediate qualities of his wool as is the buyer, in that these affect his cash return. But, in addition, he is more vitally concerned with these qualities, in that they determine the value of the wool of future generations. The fleece properties are largely hereditary. An animal with a slight predisposition toward the production of medullated fibre will probably hand on this trait to its progeny, in which it may become intensified, more especially if the other parent also possesses the same defect.

A careful study of the genetics of the various wool characteristics has been started at this College, and definite information is being accumulated. However, the experience of the breeder himself is sufficient to indicate, if he wishes to eliminate hair, the possible danger of even small amounts of medullated fibre in, for example, the shoulder and side wool of his breeding-stock. In short, looking at the question simply from the point of view of wool-improvement, and the possible ultimate elimination of medulla by improved selection, the breeder

cannot afford to rest satisfied with sheep, whose present wool may well meet every requirement of the manufacturer, if they still exhibit a tendency toward the production of hair.

Of course, it would not be economically possible at present to cull out every sheep which possessed this tendency. Furthermore, it is still an open question as to whether it would be advisable to select for the total elimination of medulla. In any case the elimination of the lesser traces of medulla would have to be the culminating stage of a gradual process.

We may, for convenience, consider three degrees of medullation: (1) Obvious coarse medulla, as in hair; (2) medulla whose presence is very doubtful to the naked eye, and which at present is usually overlooked; (3) fine medulla impossible to detect by the naked eye.

Type 1 is being guarded against by most breeders at present; type 2 usually passes undetected; type 3 is hardly ever detected at all, and up to the present has only been observed by means of a microscope. From what has been said it will be obvious that so long as selection aims only at the elimination of type 1, and allows types 2 and 3 to carry on, the elimination of hairiness in wool will be indefinitely postponed.

It is not intended to suggest that the production of medullated wool is governed entirely by heredity. External conditions such as feed, weather, shearing, &c., may help in deciding whether pure wool or medullated fibre is produced. On these points very little scientific evidence has yet been obtained. However, when it is remembered that quite commonly a sheep will be producing hair at one part of the year and pure wool at another time, from the same follicles, it seems probable that some condition or conditions other than heredity may contribute to such differences.

The available evidence suggests, therefore, the possibility that a sheep may inherit a predisposition toward the production of medullated fibre, and that, having this, under some conditions it will produce much medullation, and under other conditions it will produce less. Naturally, if this predisposition is detected and removed by selection, then the chance of medullated fibres being produced under any conditions whatever would be much lessened, even if not entirely eliminated.

The determination of these conditions, if they exist, and of their interdependence and relative importance, forms the subject of experiments now being carried out.

DETECTION OF MEDULLA IN WOOL SAMPLES.

It will have become clear from the foregoing discussion that there is need of a more delicate test for the presence of medulla in wool than that of ordinary visual examination. This is true at the present time of economic depression and low prices probably more than has been the case at any other time; for it is certain that a sure way of meeting these conditions is by improvement in quality. A test has been developed with a view to meeting these requirements.

Wilson* describes a test in which individual fibres are drawn through a shallow dish of glycerine and observed with the aid of a dim red

* J. F. Wilson, "The Medullated Wool Fibre"; *Hilgardia*, Vol. 4, No. 5 (1929).

light. Under these conditions non-medullated fibre is invisible, while medullated fibre is chalky in appearance.* While grateful acknowledgment is made of the value of the principle involved, it is considered that as a practicable breeders' test the method is subject to the main disadvantages, (1) that it cannot be carried out in the sheepyards, and, (2) that too great an amount of time and patience is required.

Investigation showed that several liquids were more or less equally efficient in distinguishing the medullated fibre, the most suitable being benzol (C_6H_6) and aniline. Aniline possesses the slight disadvantage that it slowly turns brown on exposure to air, while benzol has the advantage that it quickly evaporates off the wool and the hands of the worker, and it is this liquid that has been adopted for the test.

The new test as developed and being used at present will now be described.

A small lock of wool is first rinsed in petrol (motor-spirit) to dissolve out the grease and dirt. This preliminary treatment is only necessary in order to keep the benzol in the testing tray clean. If the latter becomes dirty the sensitiveness of the test is much reduced. The petrol is removed from the clean lock by waving it in the air till it is dry, after which the lock is teased out with the fingers into a thin uniform layer about 6 in. wide. Care must be taken to tease out the fibres evenly, eliminating bundling as much as possible. It is inadvisable to use a comb for this purpose since part of the wool is inevitably combed out.

The teased-out lock is then laid in a shallow glass tray partly filled with benzol, and is then covered with a glass plate, care being taken not to include any air bubbles among the fibres. The glass tray rests upon a piece of black velvet, or alternatively the under side of the tray is coated with black paint, and the lock of wool immersed in benzol between the two sheets of glass is viewed against this background.

Fig. 2 illustrates the device at present in use. This has been designed to lend greater speed and comfort to the worker employed all day at the test. For occasional tests on the farm a simpler outfit may be used.† The upper glass plate (Fig. 2) is hinged by means of a strip of leather to the baseboard, and leans against the upright on the left when not in use. In order to prevent the evaporation of benzol, the vapour of which becomes rather objectionable when many locks have to be examined in detail, cardboard flanges may be glued to the three sides of this plate, whose outer edges dip into a surrounding trough of mercury when the plate is lowered into position. Thus greater comfort in working and economy in the use of benzol are secured.

* The method depends on the fact that the refractive index of wool keratin is about the same as that of glycerine, with the result that very little light is reflected from the surface of the fibres when they are immersed in this liquid. At the surfaces surrounding the air cavities in the medulla there is, however, a big change in refractive index, with the result that a considerable part of the incident light is reflected.

† A leaflet describing a simplified and less fragile testing outfit for the farm, giving full details and precautions to be observed in carrying out the test, may be obtained on application to the Registrar, Massey Agricultural College, Palmerston North.

Viewed in this manner the pure wool is not actually invisible, especially when the teasing-out has not been sufficient, because of the added effect of a large number of fibres together, each reflecting a small amount of light. Medullated fibres, however, stand out bright and chalky and are easily distinguished from the silky transparent appearance of pure wool.

Thus at a glance the medulla content of the lock may be estimated, while closer survey with a hand lens reveals even the minutest trace of fragmentary medulla. The whole process occupies only five minutes.

The liquid, benzol, which is obtained as a by-product in the manufacture of tar and gas from coal, must on no account be confused with benzine or ordinary petroleum motor-spirit, from which it is quite different. Petrol is quite useless for the purpose of the test, since pure wool is almost as visible when immersed in it, as is hair. Petrol must only be used for the preliminary cleaning of the wool-sample.

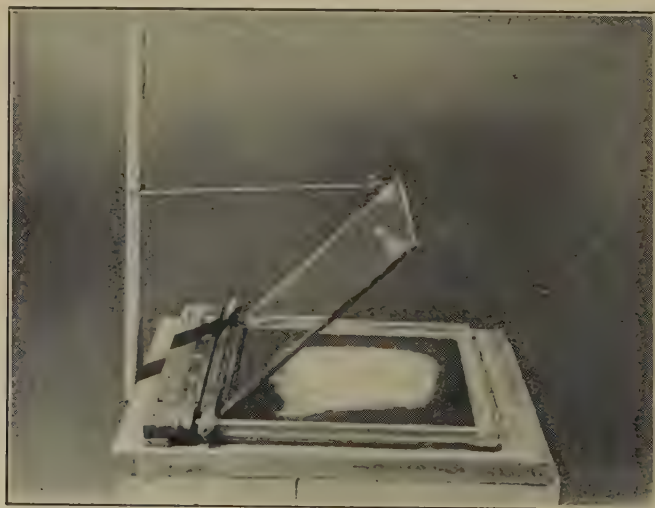


FIG. 2. DEVICE FOR DETECTION OF MEDULLA IN WOOL. (SEE TEXT FOR DESCRIPTION.)

Unfortunately, some grades of commercial benzol are obtainable which are highly adulterated with other substances. These must be avoided, and persons desirous of employing the test are specially referred to the leaflet published by this College (see footnote on page 95) with regard to supplies of benzol suitably pure for the purpose.

Care must be taken in carrying out the test, as benzol and its vapour are highly inflammable. The liquid also evaporates fairly rapidly and should be stored in a well-stoppered container.

The writer has not yet succeeded in obtaining photographs which accurately reproduce the appearance under the test of the finer traces of medulla. However, Fig. 3 illustrates the appearance under the test of the three locks of wool shown, in their natural condition, in Fig. 4.

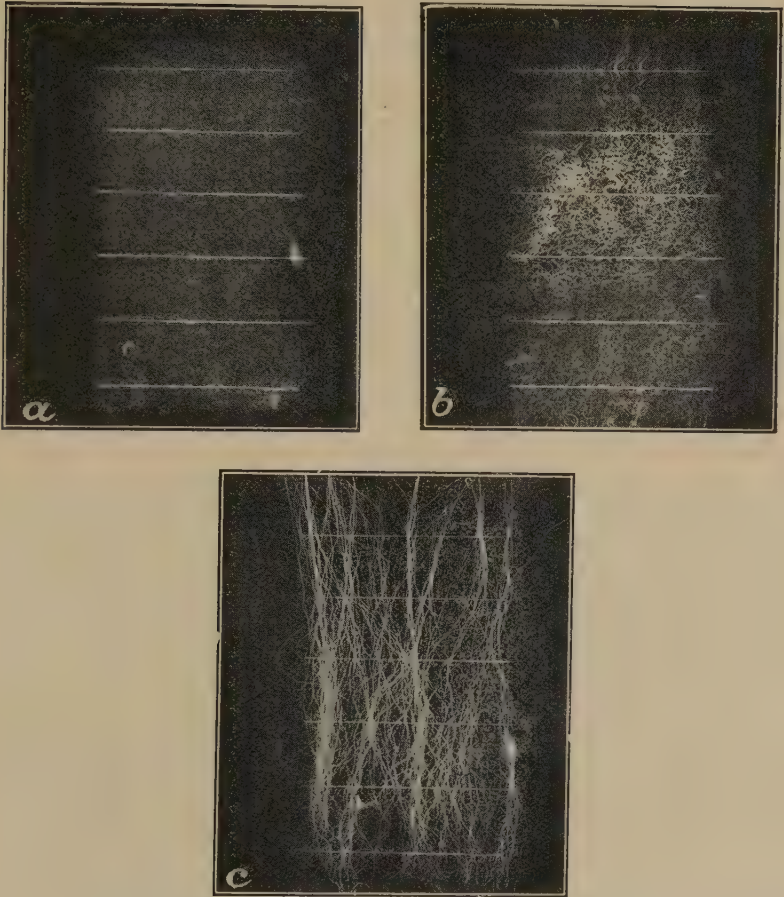


FIG. 3. APPEARANCE, UNDER THE TEST, OF THE THREE LOCKS OF WOOL SHOWN IN THEIR NATURAL CONDITION IN FIG. 4. (SEE DETAILS ON NEXT PAGE.)

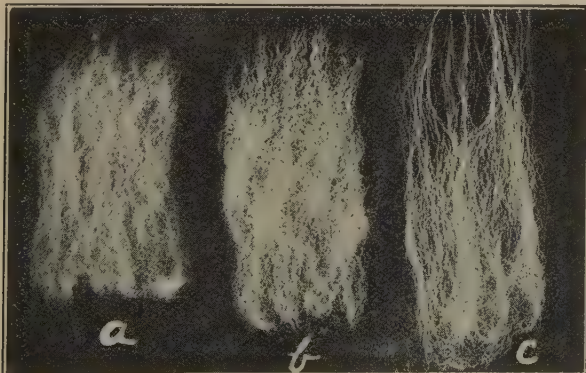


FIG. 4. THE THREE LOCKS IN NATURAL CONDITION.

The white horizontal lines are engraved 1 in. apart on the upper glass plate of the testing apparatus for convenience in describing the distribution of the medulla in the lock.

Lock (a) is all pure wool, containing no medulla at all.

Lock (b), taken from a very superior fleece, was not thought to contain any medulla at all until put to the test. In the figure it is seen that the outer half of this lock, with the exception of the actual tips, is strongly medullated; while the inner half contains only a few medullated fibres. A few of the tips also are medullated.

Lock (c), chosen for contrast, is an exceedingly hairy sample, so that the bulk of it shows up bright and chalky under the test. It will be noticed, however, that much of the butt end of this lock is invisible in the benzol, and is therefore of pure unmedullated wool. The test is not, of course, needed for the detection of such cases of hairiness as this, which are obvious to the naked eye.

REPRESENTATIVE SAMPLES.

We have now to consider to what extent a single lock selected, for example, from the side of a sheep is representative of the whole of the side wool. Investigation shows that, in the fleeces already examined, there is a considerable variation in the amount of medullated fibre from one position to another—even to the extent that adjacent locks—and, indeed, the two halves of a single lock—may differ very much from one another in this respect.

Examination of a number of fleeces is being carried out with a view to determining the smallest number of locks which may be relied on as a representative sample of either the whole fleece, or, preferably, of a given part of the fleece. It is obvious that until this question is satisfactorily settled the usefulness to the breeder of the test here described will be to a certain extent limited.

The writer wishes to express his indebtedness to Mr. W. G. Sutton, who initiated this work, and to the other members of the Wool Research staff of Massey College for their helpful suggestions and assistance.

Oversalting of Cheese.—The Director of the Dairy Research Institute reported as follows on this subject at the last meeting of the Dairy Research Management Committee: "Last year's experimental work showed that heavy salting of cheese had a very bad effect upon cheese body. It showed that excessively heavy salting resulted in harsh, dry bodies, a fault that is frequently commented upon by cheese buyers. By arrangement with the Director of the Dairy Division, samples of ordinary market lines of cheese were obtained from the grading stores throughout the Dominion, and the salt content of these cheeses was estimated. Care was taken to select particular types in order that some correlation might be made between salt content and type of body. Some of these samples proved to contain excessive quantities of salt, which would appear to be playing a part in bringing about the harshness of body characteristic of these samples. It is not claimed that heavy salting is the only cause of harsh body; indeed, some samples indicated that such is not the case. There undoubtedly are other factors playing a part in this connection; but since the rate of salting is one factor, it is a matter for the cheesemakers to study closely. The concentration of salt in cheese has led to other studies on the effect of salt in cheese-ripening; this matter is being given attention."

NITROGEN DRESSING OF DAIRY PASTURES.

EXPERIMENTS ON PRODUCTION, SEASONS 1928-29 AND 1929-30.

Fields Division and Plant Research Station, Department of Agriculture.

IN the winter of 1928 Imperial Chemical Industries, London, donated considerable supplies of sulphate of ammonia and some Nitrochalk to the Department of Agriculture for experiments on grasslands in New Zealand, and Mr. R. Lindsay Robb, London, chief grasslands advisor to Imperial Chemical Industries, was seconded to the Department to advise and assist in the programme of work undertaken. Further donations in 1929 and 1930 enabled the work to be continued, although a number of the trials started in 1928 were abandoned in 1929 and still more in 1930. However, several new trials were laid down in 1929.

SCHEME OF EXPERIMENTS.

The scheme adopted was inaugurated by Mr. A. H. Cockayne, then Director of the Fields Division. The object was to determine the effect of using nitrogen as an adjunct to the ordinary manuring with minerals practised on those dairy-farms on which experiments were conducted. Although some farmers were using lime and potash, the most important mineral fertilizer being used was phosphate.

Each trial consisted of a comparison between (1) a field on which mineral manures only were used (referred to as the "control" field); (2) a field on which the same minerals were used as on No. 1 with nitrogen in addition (referred to as the "nitrogen" field).

Each pair of fields was obtained by dividing an existing fairly uniform field into two equal parts, or by selecting a pair of fields which were originally one field but which had been subdivided subsequent to sowing down and some time prior to the commencement of the experiment. In a few cases the fields selected were dissimilar in history, but very similar in production and botanical composition.

The fields selected were of such a size that when the available milking-herd was put on the stocking was at the rate of from eight to sixteen cows per acre. A system of alternate grazing and spelling was adopted which in the main resulted in from one to three days' grazing alternating with from ten to twenty days' spelling, during the period from September to January. At other times of the year the duration of grazing and spelling depended largely on the weather conditions prevailing in each district. The aim was to allow the herbage to attain a height of 4 in. to 5 in. in each field, and then graze it down rapidly with milking-cows, which were followed by dry stock where the latter were available.

NOTE 1.—On the average dairy-farm in New Zealand dry stock are not carried in sufficient numbers to be considered seriously as "followers" to the milking herd; consequently effective utilization and management of pastures without punishing the milking-cows is not by any means an easy matter. For really effective control the use of the mower has to be resorted to at least once or twice a year to clean up patches of unconsumed roughage. Some farmers preferred, or were forced by conditions of growth, &c., to graze at a shorter stage than that mentioned.

The records consisted of (1) kind of stock, (2) numbers of stock, (3) time on each field, (4) production of butterfat from milking-cows at all times of the year, (5) dates and quantities of application of nitrogen and phosphates, (6) dates of harrowing.

NOTE 2.—The records of butterfat production were usually taken from the test of each ten-day composite sample of cream or milk, whichever was supplied to the factory. The object of recording the butterfat was *not* to try and determine the difference between the production value of nitrogen-treated grass as compared with grass having only phosphate, but to enable cow-days to be expressed approximately in terms of their equivalent butterfat.

NOTE 3.—During the spring and early summer months each field was harrowed after every grazing or after every second grazing. In the mid and late summer very little harrowing was done, on account of the comparatively small rainfall rendering cleansing of the grass from smeared droppings rather uncertain. Thorough harrowing in autumn was generally practised in order to spread the droppings which had accumulated during the dry weather.

Experiments in Season 1928-29.

Trials were laid down on ninety-one pairs of fields on eighty-one farms. All of these were in the North Island. (On a few farms two pairs of fields were selected.) After elimination of a number of farms on account of unsatisfactory management or recording, seventy-four pairs of fields were used for compilation of the data here presented.

In this season sulphate of ammonia was used, with the exception of a few trials on which Nitrochalk was applied. On account of the very few Nitrochalk trials no attempt has been made to distinguish between these two materials in examination of the data.

SYSTEM OF MANURING ADOPTED.

The English system of comparatively small but fairly frequent applications of nitrogen was adopted, and the following programme of dressings per acre was followed as closely as possible: 1 cwt. in July, 1 cwt. in October, 1 cwt. in December-January, 1 cwt. in March-April. On account of arrangements being rather hurried the initial application was not made until September in a number of trials, and as late as October in a few cases.

PASTURE-MANAGEMENT.

Utilization of grass, especially on the nitrogen-dressed fields; was not always highly satisfactory, due in the main to allowing too great a growth to accumulate before the first grazing. This difficulty was largely overcome in the second season, when the fields were stocked at a slightly shorter stage of growth. The difficulties of insufficient dry stock to clean up effectively after the milking-herd have already been mentioned. (See Note I.)

GENERAL EFFECT OF APPLICATIONS.

Generally speaking, the July and August dressings in 1928 showed very good results in stimulating earlier growth of grasses, particularly rye-grass, cocksfoot, and Yorkshire fog. This last-named and much despised grass appears to be responsible for the production of a good deal of butterfat, especially in the early spring, and whether it is deserving of the contempt usually bestowed upon it is, in the opinion of the writers, a worthy subject for investigation, particularly under conditions of good pasture-management.

The dressings applied in October and December did not appear to give, relative to the phosphate-only fields, as good results. In a number of cases, too, the clovers suffered somewhat as a result of "burning" of the soluble nitrogen, and did not recover until the autumn. Moreover, from October to January, under the present type of pasture-management, there is almost invariably a huge wastage of grass through improper utilization. Consequently, at the present stage, the use of *summer* dressings of nitrogen accentuates the wastage, and does not appear to be justified on *the average farm at the present time*. It is possible, however, that the use of nitrogen in October may be justified for the production of grass for early silage. (Consideration of these points caused an alteration in the system of applying nitrogen in the 1929-30 season.)

The autumn application was not so consistent in effect as the first, but in the main caused quite a good growth of grass.

ANALYSIS OF RECORDS.

The records for the 1928-29 season have been examined in order to see whether they disclose any connection between certain pasture characteristics on the one hand and the results in carrying-capacity or butterfat production on the other hand. The special questions to which attention has been directed are: (1) Is there a connection between the productivity of the original pasture and its response to nitrogen? (2) Does the date of the first application of nitrogen influence the total result for the season?

GENERAL RESULTS.

The figures from the seventy-four trials which have been analysed show:—

(1) The average production from the nitrogen-dressed fields was 278.5 cow-days per acre (Note 4), which is approximately equivalent to 259 lb. butterfat. (Over the whole season the average production from one cow-day was 0.93 lb.)

(2) The average production from the control fields was 234.0 cow-days per acre (Note 4), which is approximately equivalent to 217.5 lb. butterfat.

(3) The increased yield due to applications of nitrogen was 44.5 cow-days per acre, which is equivalent to 41.5 lb. of butterfat, or, more correctly, 42.4 lb., when the difference in butterfat per cow-day for each period is taken into consideration as in Table 1. In addition there was an average increase in grazing of 7.7 dry-stock days (Note 5) per acre in favour of the nitrogen fields.

(4) The average increase in yield for each hundredweight of nitrogenous manure used was 13.5 lb. butterfat. (An average over all trials of approximately 3.1 cwt. of sulphate of ammonia per acre was used.) It would be unfair to assess the value of nitrogen merely on the differences in butterfat as represented by so many cow-days. The value of "out of season" grass is commented on under the heading of "General Discussion" later in this article. Further, Table 1 shows a higher production per hundredweight of sulphate of ammonia on the farms of the naturally higher-production group than those in the lower-production group.

NOTE 4.—“Cow-days per acre” represent the number of cows which are required to consume the herbage on 1 acre in one day. Twenty cows on 1 acre for one day would give twenty cow-days per acre. Likewise five cows on 1 acre for four days would also represent twenty cow-days per acre. Expressing results in cow-days gives a better indication of the actual differences in feed produced over the whole year than does butterfat per acre. It will be noticed in Table 1 that for the period ending 31st October, 1928, one cow-day yields 1.1 lb. butterfat, whereas during the period 1st April, 1929, to 30th June, 1929, when cows were drying off, one cow-day yields only 0.67 lb. butterfat.

NOTE 5.—Dry-stock days in this season were recorded without reference to age of stock. As heifers were often used as followers, the dry-stock days are not equivalent to dry-cow days, but since the same class of stock was used on both trial fields the figures are comparable. In 1929-30, however, age of stock was taken into consideration and dry-stock days were converted into the equivalent of dry cows per acre.

CONNECTION BETWEEN PRODUCTIVITY OF ORIGINAL PASTURE AND RESPONSE TO NITROGEN.

Table 1 shows the seventy-four trials under review divided into two groups representing (1) the relatively high-producing pastures; (2) the relatively low-producing pastures. No doubt a few of these trials which fall in the low group have done so simply as a result of the lateness of the season of starting (see Table 2). Had all trials been dressed about the same time as the earlier ones a subdivision into smaller groups would have been justified.

Table 1.—*Farms grouped according to Production in Cow-days per Acre from Control Fields, showing Average Increases due to Nitrogen at different Periods of Season (1928-29), and Average Increases in Cow-days per Hundredweight of Sulphate of Ammonia used.*

Number of Trials.	Range of Production of Control Fields in Cow-days per Acre.	Average Increases in Cow-days per Acre of Nitrogen Fields over Control Fields.					Average Amount of Sulphate of Ammonia used per Acre.	Average Increase in Cow-days for each 1 cwt. Sulphate of Ammonia used.
		First Period: From First Application to 31/10/28.	Second Period: 1/11/28 to 31/12/28.	Third Period: 1/1/29 to 31/3/29.	Fourth Period: 1/4/29 to end of Season.	Total.		
37	Over 220 ..	17.6	11.4	10.4	13.9	53.3	Cwt.	
37	Below 220 ..	11.8	8.1	9.4	6.4	35.7		15.6
..	Average ..	14.7	9.7	9.9	10.2	44.5		12.7
								14.3
<i>Above Averages expressed in Pounds of Butterfat for Season.</i>								
..	..	16.0	10.9	8.7	6.8	42.4	..	..

The table gives the response to nitrogenous manuring in cow-days per acre through different periods of the year. These periods have been taken so that as far as possible the beginning of each period coincides approximately with the time of application of one of the four dressings of nitrogen. They are as follows:—

(1) From the date of the first application up to 31st October. The major part of this period is one of comparatively low production, and it is considered that in view of the value of any extra feed which

may be produced during this time nitrogen dressings will show more promise of giving economic response than at any other time of the year.

(2) Between 1st November and 31st December: This coincides with a time of normally high production and when—under present conditions, when maximum utilization of herbage is the exception rather than the rule—extra grass is least necessary, unless full use is made by conserving it in the form of silage or hay.

(3) Between 1st January and 31st March: During this period pasture-production begins to decline, and in most districts of the North Island a dry spell occurs at some part.

(4) Between 1st April and the end of the milking season (Note 6): During this time grass shortage usually becomes acute, and extra grass lessens the necessity of providing supplementary feed. Although an autumn flush of growth can be expected, especially in the northern districts, it rarely meets the full requirements of stock.

NOTE 6.—For purposes of these experiments the "end of the season" was represented by the last grazing (which usually occurred in late June or early July) prior to the late winter application. In those experiments which were not being carried on in the following season records were taken to the end of June.

The figures in Table 1 indicate that high natural yields per acre and high returns from nitrogenous fertilizers are definitely associated. In other words, the greater the productivity of the original pasture the better are the results which may be expected from nitrogenous top-dressing of the pasture. The superiority of the thirty-seven trials with higher natural yield is greatest in the first and the fourth periods, even taking into consideration the fact that the second period is of two months' duration as compared with three months for the other periods.

CONNECTION BETWEEN DATE OF FIRST APPLICATION OF NITROGEN AND TOTAL RESULT FOR SEASON.

Table 2 is a summary of the trials considered in this respect. The records strongly suggest that better returns, to the extent of about 50 per cent., were obtained when the first application of nitrogen was made in July, as compared with the returns when the first application was made in September or later.

Table 2.—*Influence of Date of First Application of Nitrogen on Results for Whole Season.*

Month of First Application.	Number of Farms.	Average Amount of Sulphate of Ammonia applied per Acre.	Average Increase of Butterfat for each Hundredweight of Sulphate of Ammonia used.
		Cwt.	lb.
July	39	3'1	15
August	16	3'25	12'5
September or October .. .	19	3'1	10'8

Those trials in which the first applications were made in July and August are shown in Table 3 in their respective districts, with the results obtained to 31st October in each case. The table shows that July dressings of nitrogen—in North Island districts, at least—are more efficient in promoting extra grass for this period of normally low production. Although the numbers of trials in the individual groups are small in some cases, the difference between the averages for the July and August applications may be regarded as having some significance.

Table 3.—Trials in which First Application of Nitrogen was made in July and August grouped according to District, showing Average Increase in Butterfat per Acre to 31st October, 1929.

District.	Month of Application of First Dressing of Nitrogen.			
	July.		August.	
	Number of Trials.	Average Increases in Butterfat per Acre to 31/10/29.	Number of Trials.	Average Increases in Butterfat per Acre to 31/10/29.
North Auckland	6	23'1	1	—6'0
South Auckland	1	46'0	3	41'0
Bay of Plenty	5	19'7	..	..
Waikato	8	16'0	8	5'0
Taranaki	11	12'2	4	7'2
Manawatu	8	32'5	..	..
Average of 39 trials ..	..	20'4	Average of 16 trials	11'6
<i>Expressed as Percentage of Total Extra Production.</i>				
..	..	44'0	..	28'5

A total of nineteen farms received initial dressings during September which were not included in Table 3, since production from these up to the end of October was very small indeed. It is an interesting fact, however, that the extra production up to the end of December from these trials was not as great as was the extra production up to the end of October from the July applications. In the north and central Auckland districts September applications were particularly unresponsive compared with July dressings. The increase from the July dressings up to the end of October was 44 per cent. of the total increase of the July group for the season, while that from the August dressings was only 28·5 per cent. of the total increase from the August group.

The records in Tables 2 and 3 suggest that the superior returns when the first application is made in July are due to the fact that the period of more active growth is advanced, whereas the response to later applications corresponds with the period of active growth, and that during this period nitrogen is less effective in promoting *extra* growth.

EFFECT OF FIRST APPLICATION OF NITROGEN COMPARED WITH THAT OF SUBSEQUENT APPLICATIONS.

In view of the fact that the influence of the first application of nitrogen may be continued after the second application is made, and

that the second may exert some influence on the results from the third, it is not possible for the responses from the various dressings during the 1928-29 season to be segregated. It would appear, however, from Table 1 that since the first period was not influenced by residual effect from any previous treatment its superiority as shown by the figures has a greater significance.

According to observations made on the trials during the 1928-29 season the greatest response in colour and growth from the use of nitrogen occurred after the first and the autumn applications. In a good number of trials the applications made between October and February had no visible effect.

Experiments in Season 1929-30.

Most of the 1928-29 trials were carried on and added to in the following season, principally by their extension to the South Island, and particularly Southland. One hundred and fifteen pairs of fields were under trial on eighty-seven farms. Of these eighty-four have been considered in the compilation of results. Those eliminated had some fault, either in their management or accuracy of keeping records.

SYSTEM OF MANURING ADOPTED.

The previous season's trials indicated very clearly that the most valuable use for nitrogen was in the production of early spring grass and late autumn grass. If its use is not profitable at these times, then it is unlikely to find a place in grassland dairy-farming in New Zealand.

As already mentioned, the use of nitrogen for production of summer grass was making already bad utilization much worse; consequently the programme of dressings decided upon was as follows: 1 or 2 cwt. in June-July, 1 cwt. in March-April. Since the July dressing in 1928 was more effective than later ones it was considered advisable to make some applications even earlier in 1929. In some cases, particularly in the Auckland District, a 1 cwt. dressing in June-July was applied while in others 2 cwt. was used.

PASTURE-MANAGEMENT.

The experience of the previous year enabled better utilization to be carried out in the 1929-30 season. This was achieved mainly by stocking fields at a slightly shorter stage of growth.

GENERAL EFFECT OF APPLICATIONS.

The response to June applications could not be considered satisfactory in the main. Apparently soil-temperature was too low for some time following application to allow growth to take place satisfactorily even though nitrogen was applied. When response to the June application did result this did not appear to be as satisfactory as the response to the July application on similar pasture. The July dressings gave very good results in nearly all cases. In late districts of the North Island and in the South Island July is probably too early, and applications would be better delayed until August.

In the 1929-30 summer some fields, although showing a thicker grass sole, were decidedly reduced in clover content as a result of the

nitrogen application. In other cases no difference between the trial fields in the clover content could be observed. Reduction in clover, so long as there was a compensating increase in the better grasses, did not appear to be a serious matter. In two of the trials where clover reduction was most marked the rye-grass was considerably improved, the net result being a good increase in carrying-capacity from the use of nitrogen. In other cases the reduction in the amount of clover appeared to lessen the productive capacity of the pasture in the late summer.

The autumn dressing was rendered rather ineffective by a dry autumn, but certainly increased growth in most cases.

ANALYSIS OF RECORDS.

The dressings of nitrogen applied to the trial fields during the 1929-30 season were limited to an application in late winter and in some cases a second one during the autumn. The records have been examined from the following aspects: (1) General results from nitrogen applications; (2) effect of nitrogen in stimulating earlier feed; (3) duration of effect from nitrogen; (4) factors affecting response from nitrogen; (5) response from autumn dressing of nitrogen.

The general results from the eighty-four trials from which figures were taken were:—

(1) The average production from the nitrogen-dressed fields was 280.6 cow-days per acre, representing a production of about 275 lb. butterfat. (Over the whole season the average production for one cow-day was 0.98 lb.)

(2) The average production from the control fields was 243 cow-days per acre, representing a production of about 238 lb. butterfat per acre.

(3) The increased production due to nitrogen was 37.6 cow-days per acre, which is equivalent to a gain of approximately 37 lb. butterfat. In addition, there was an average increase in grazing of two dry-stock days (see Note 5) per acre in favour of the nitrogen-dressed fields.

(4) The average increase for each hundredweight of sulphate of ammonia used (including that applied in autumn) was 18.8 cow-days per acre, which is equivalent to 18.5 lb. butterfat per acre.

EFFECT OF NITROGEN IN STIMULATING EARLIER FEED.

Table 4 shows an analysis of the effect of nitrogen in promoting earlier growth. Districts are grouped into relatively early and relatively late.

Earlier Districts.—It will be seen that the average time between applying nitrogen and the first grazing for the season is forty-six days, and that the nitrogen fields were grazed nearly ten days earlier on the average than the control fields, the greatest hastening of feed being thirty-six days.

The average number of cow-days for the first grazing of the nitrogen fields was about twenty-eight, as against about twenty-one on the control fields, and in every district more grazing-days were

obtained from the nitrogen than from the control. (In eight cases two distinct grazings were obtained from the nitrogen fields before the control fields were grazed.) Obviously the nitrogen fields carried more feed at the time of grazing than did the control fields, and this indicates that the average difference of ten days' earlier feed on the nitrogen fields should be greater.

In this connection it should be noted that whereas the nitrogen fields usually carried a fairly uniform growth all over, the controls generally displayed a patchy growth, and the time of grazing had to be governed by the growth on the longer patches. Hence the control fields were grazed at a relatively shorter stage for the average of the whole field than were the nitrogen fields. Under good conditions it appears that an application of nitrogen about July will give feed a fortnight to a month earlier than usual.

Table 4.—Effect of Nitrogen in promoting Earlier Feed in different Districts and Number of Cow-days from the First Grazing.

District.	Number of Trials.	First Grazings of Nitrogen Field.				First Grazings of Control Field.	
		Average Number of Days after First Application of Nitrogen.	Number of Days Earlier Grazing than Control.			Average Number of Cow-days per Acre obtained.	Average Number of Cow-days per Acre obtained.
			Greatest.	Lowest.	Average.		
Earlier Districts.							
North Auckland	12	40.3	34	—2	17.8	36.3	25.7
South Auckland	11	46.6	36	—1	7.5	23.1	20.3
Bay of Plenty	8	53.9	30	2	11.6	40.6	23.4
Waikato ..	15	41.1	21	—4	5.9	24.7	19.3
Taranaki ..	15	52.2	26	—5	7.0	21.2	19.0
Manawatu ..	5	43.0	16	4	10.4	25.4	13.6
Average ..	..	46.1	..	..	9.6	27.7	20.6
Later Districts.							
Wairarapa ..	6	72.7	11	3	5.5	30.3	18.3
South Island	12	75.7	30	4	12.2	28.2	28.0
Average ..	..	74.7	..	..	10.0	29.0	25.9

Later Districts.—In the Wairarapa the same differences in number of days' grazing obtained were evident as in the early districts, but in the Otago-Southland district the growth on the differently treated fields was evidently very similar in amount, although twelve days earlier on the average and as much as thirty days earlier in one case.

The time between the date of application and the first grazing was nearly thirty days more than for the average of the earlier districts. This suggests that the application of nitrogen in the later districts might be delayed advantageously until August, as experience in the earlier district indicated that application in June was not as useful as in July, although the results of the August application in Otago-Southland (Table 6) do not substantiate this.

DURATION OF EFFECT FROM NITROGEN.

Table 5 is intended to show the distribution of response from nitrogen over the four periods of the season. In this table the trials are grouped according to their total response, and the average quantities of phosphate and nitrogen applied are also shown. It will be seen that in all groups there is an increase in favour of nitrogen during the first period. This increase is well maintained except in the lowest group, where there is a marked decline during the next period. There is general decline in all except the highest group during the third period. A second application of nitrogenous fertilizer was made to about half the farms immediately before or during the last period, which accounts for the greater part of the response shown during that period. The response

Table 5.—Farms grouped according to Response from Nitrogen in Cow-days per Acre, showing Average Amount of Fertilizer applied and Response through different Periods of the Year.

Number of Trials.	Range of Increase due to Nitrogen in Cow-days per Acre.	Average Amount of Nitrogenous Fertilizer used per Acre during Season.	Average Amount of Phosphatic Fertilizer used per Acre.	Average Increase in Cow-days per Acre in Favour of Nitrogen Field.					
				First Period — From Time of Application to 31/10/29.	Second Period — 1/11/29 to 31/12/29.	Third Period — 1/1/30 to 31/3/30.	Fourth Period — 1/4/30 to End of Season.	Total.	Increase per Hundred-weight of Nitrogenous Fertilizer applied.
12..	Over 100	2.4	4.1	32.2	38.5	33.4	24.8	129.0	53.7
12..	50-100..	2.2	3.7	18.6	30.2	9.6	8.9	67.2	30.5
25..	25-50 ..	2.0	3.3	13.0	15.8	-0.2	7.2	35.8	17.9
21..	0-25 ..	2.0	3.5	8.9	8.8	-6.4	0.1	11.5	5.8
14..	Less than 0	1.8	3.7	4.0	-9.8	-14.7	2.6	-23.1	-12.8
Mean	..	2.0	3.6	14.0	15.1	1.9	6.6	37.6	18.8

from the last application on only those farms receiving nitrogen is shown in Table 10. The effects of the first application have therefore on some farms been continued right up till the second application in autumn, whereas in others, where the initial response was poor, what slight effect there has been has disappeared during the third period.

The average increase from the time of first application of nitrogen up to 31st March, 1930, was thirty-one cow-days per acre in favour of the nitrogen field. Since the average amount of nitrogenous fertilizer applied was 1.55 cwt., the average increase for each hundred-weight of nitrogenous fertilizer applied in late winter was 20 cow-days per acre.

Referring to Table 10, it will be seen that for each hundredweight of nitrogenous manure applied in autumn there is an increase of 13.3 cow-days per acre.

FACTORS AFFECTING RESPONSE FROM NITROGEN.

Since there has been such diversity of results in the eighty-four trials, it will be well to examine the conditions or factors contributing to response. It is now generally realized that nitrogenous manures cannot be expected to give payable results when applied indiscriminately, and that profitable results will only be brought about under certain conditions.

(I) TIME OF APPLICATION.

During the previous season this factor appeared to have an important bearing on response, and July dressings were much better than August or September applications. Table 6 shows the effect of dressings during June, July, and August respectively, up to the end of December, and although the number of trials on which applications were made in June or August is limited for comparison, there is every indication that July dressings were again most successful. This is borne out by observation, although it is probable that August application may be better in the South Island. The results for the South Island do not substantiate this, but the number is rather limited.

Table 6.—Trials grouped according to Time of Nitrogen Dressings, showing Average Increases over Controls in Cow-days per Acre to 31st December, 1929.

District.	Month of Application of First Dressing of Nitrogen.								
	June.			July.			August.		
	Number of Farms.	Average Increase in Cow-days per Acre.		Number of Trials.	Average Increase in Cow-days per Acre.		Number of Trials.	Average Increase in Cow-days per Acre.	
		Period—From Time of Application to 31/10/29.	Period—1/11/29 to 31/12/29.		Period—From Time of Application to 31/10/29.	Period—1/11/29 to 31/12/29.		Period—From Time of Application to 31/10/29.	Period—1/11/29 to 31/12/29.
North Auckland	6	7.3	7.7	10	12.3	12.2	3	14.3	3.3
South Auckland				8	22.1	8.2			
Waikato ..				12	11.0	17.1			
Bay of Plenty ..				7	30.9	33.6			
Taranaki ..	7	10.3	18.3	7	15.9	10.7	..	..	..
Manawatu ..	..	..	..	5	24.6	21.2	..	..	..
Wairarapa ..	..	..	..	6	10.7	21.6	..	..	..
South Island ..	1	..	14.0	8	5.4	10.7	3	Nil	10.6
Average ..	14 trials	8.3	13.4	63 trials	15.7	17.3	6 trials	7.1	6.9

(2) TYPE OF ORIGINAL PASTURE.

Table 7 shows farms grouped according to production from control fields in cow-days per acre. The 1928-29 season's results indicated that one might expect better results on a good pasture than on a poor one. It will be seen that in all periods, except the third, there is a distinct correlation between natural yield of pasture as measured in cow-days per acre and response from nitrogen. Since during these periods rye-grass is relatively more vigorous than other species, and that in the main the pastures of the higher-producing groups were

better in rye-grass than those in the lowest group, it is reasonable to conclude that the better the rye-grass content of the pasture the more the pasture responds to nitrogen during the early spring and late autumn. This is in accord with experience in Britain.

Table 7.—*Trials grouped according to Production from Control Fields in Cow-days per Acre, showing Increases due to Nitrogen for different Periods and for each 1 Cwt. of Sulphate of Ammonia used.*

Range of Production on Phosphate Field.		Increase due to Nitrogen in Cow-days per Acre.						
Cow-days per Acre.	Number of Trials.	First Period— From Time of Application to 31/10/29.	Second Period— 1/11/29 to 31/12/29.	Third Period— 1/1/30 to 31/3/30.	Fourth Period— 1/4/30 to End of Season.	Total.	Average Amount of Sulphate of Ammonia used per Acre.	Average Increase in Cow-days for each 1 cwt. of Sulphate of Ammonia used.
Above 300	17	19·7	24·1	3·6	11·1	58·5	Cwt. 2·4	24·8
250-300 ..	25	13·7	15·2	Nil	8·5	37·4	2·1	18·0
Less than 250	42	11·6	11·3	2·8	3·9	29·6	1·9	15·5

(3) THE AMOUNT OF NITROGEN APPLIED.

Table 8 shows the trials in Auckland Province arranged according to the amount of nitrogen applied. There were not sufficient trials where 1 cwt. of nitrogen was used to give a fair comparison in the other districts. The figures indicate a smaller superiority of the 2 cwt. over the 1 cwt. applications than was expected. Judging by the appearance in spring of those pastures which received 2 cwt. sulphate of ammonia, it was anticipated that the response from this dressing would be approximately twice as great as that from the 1 cwt. dressings.

Table 8.—*Trials in Auckland Province showing Amount of Nitrogen applied in First Dressing and Response to 31st March, 1930.*

Amount of Sulphate of Ammonia per Acre.	Number of Trials.	Average Amount of Phosphate per Acre.	Response from Nitrogen in Cow-days per Acre.			
			First Period— Time of Application to 31/10/29.	Second Period —1/11/29 to 31/12/29.	Third Period —1/1/30 to 31/3/30.	Total to 31/3/30.
Cwt.		Cwt.				
1	24	3·8	14·2	14·5	0·8	27·9
2	22	4·3	17·5	14·5	7·1	39·1

(4) EFFECT OF AMOUNT OF PHOSPHATE ON NITROGEN RESPONSE.

Table 5 shows the average dressing of phosphatic fertilizer for the different nitrogen-response groups. The group giving the lowest

response has received almost as much phosphate as the highest. It is obvious, therefore, that *amount* of phosphate per acre has not limited the nitrogen effect in these trials.

(5) EFFECT OF APPLYING PHOSPHATE AT ABOUT THE SAME TIME AS THE FIRST APPLICATION OF NITROGEN.

Table 9 shows that where the phosphate dressing was applied at the same time or within four weeks of the nitrogen dressing the average increase from twenty-eight trials is nearly fifty-five cow-days per acre, as compared with an average increase of twenty-nine cow-days from fifty-six trials on which the phosphate was applied at some other season of the year. The differences between the two groups are most marked in the second, third, and fourth periods.

Table 9.—Response from Nitrogen in Cow-days per Acre on (A) those Trials receiving Phosphate within Four Weeks of Initial Dressing of Nitrogen, and (B) remainder of Trials on which the Phosphate Dressing was applied at some other Season.

Number of Trials.	Group.	Average Amount of Nitrogen per Acre in First Dressing.	Average Increase in Cow-days per Acre in Favour of Nitrogen Field.				Total.
			First Period— From Time of Application to 31/10/29.	Second Period —1/11/29 to 31/12/29.	Third Period —1/1/30 to 31/3/30.	Fourth Period —1/4/30 to End of Season.	
28	A	Cwt. 1·5	13·3	21·2	9·3	10·9	54·7
56	B	1·5	14·3	12·1	—1·7	4·5	29·2

Group A received on an average 3·8 cwt. of phosphatic fertilizer, while group B received 3·5 cwt. The small difference in amount of phosphate applied is negligible. These results at least indicate the desirability of investigations of a more refined nature being conducted on this aspect of the use of nitrogen.

RESPONSE FROM AUTUMN APPLICATION.

In Table 10 the responses from thirty-nine trials to which an autumn application of 1 cwt. of sulphate of ammonia was applied have been analysed. The results again indicate the greater value of nitrogen on the higher-production pastures.

Table 10.—Trials receiving Nitrogenous Dressing in March–April grouped according to Production from Control Field, showing Increases due to Nitrogen.

Range of Production on Control Field in Cow-days per Acre.				Number of Trials.	Average Increases due to Nitrogen in Cow-days and Dry-stock Days per Acre from March–April Application to End of Season.	
					Cow-days per Acre.	Dry-stock Days per Acre.
Over 36	..	..	..	19	19·4	1·8
Under 36	..	..	..	20	7·4	1·2
Average	..	..	..	..	13·3	1·5

General Discussion.

ERRORS ASSOCIATED WITH EXPERIMENTS.

A high degree of accuracy in the measurement of these results from the use of nitrogen cannot be claimed. The system of trial did not allow of the testing of the accuracy of each individual trial. The chief errors are due—

(1) To inequality of the individuals of each pair of fields. It is practically impossible to divide any field into two absolutely equal parts, consequently any errors due to differences in natural fertility of the trial fields will be proportionate to the difference in fertility.

(2) To differences in efficiency of grazing. Grazing periods were usually a number of twenty-four-hour days plus, in some cases, a twelve-hour period (daytime or night-time). It is difficult to decide to within a few hours when a field is grazed out, and while one field may be slightly undergrazed the one with which it is being compared may be slightly overgrazed.

It must be remembered, however, that errors would tend to be compensating, so that the general result of the group of experiments is probably very near the truth. Errors due to (1) above would tend to be levelled out by the fact that although the control fields may have been of better initial fertility in some cases the nitrogen fields would be the better in other cases. Errors due to (2) could reasonably be expected to be levelled out on each individual trial over a period of a year.

Increasing the accuracy of individual trials by replicating fields would necessitate a considerable reduction in the number of localities under trial.* It is questionable with trials such as these whether a few highly accurate trials are better than a large number of less accurate trials in which compensating errors must come into play.

VALUE OF "OUT-OF-SEASON" GRASS.

Unfortunately, the trials give no information regarding the effect of "out-of-season" grass on the cow production over the season as a whole. Extra early grass must have an effect in this respect by bringing cows to the lactation peak earlier. Unfortunately the point could be determined only by an elaborate and costly experiment extending over a considerable period.

ECONOMIC ASPECT OF THE RESULTS OBTAINED.

In view of the preceding remarks regarding "out-of-season" grass, the writers are extremely diffident about making comments on the payable nature of the returns. As indicated previously, it would be unfair to use only the increase in cow-days, as represented by so much butterfat, as a measure of the value of the nitrogen dressings. Apart from the value of extra early or extra late grass in reducing the amount of supplementary feed required, a considerable value must be attached to the early grass, especially for early-calving herds, in bringing forward the peak period of production.

The experience gained in the first season enabled the nitrogen dressing to be applied and used to better advantage in the second

season, with the result that on the average 18.5 lb. of extra butterfat resulted from each hundredweight of nitrogenous fertilizer used, as compared with 13.5 lb. in the first season.

The profit represented by this increase will vary according to prices of nitrogen and butterfat, and the costs of railage, cartage, and distribution. Although the general average increase of 18.5 lb. butterfat for each hundredweight of nitrogen used does not represent a big profit at present prices, the value of the early feed produced must not be lost sight of. The net cost of sulphate of ammonia is now about 12s. per hundredweight. It requires about $9\frac{1}{2}$ lb. butterfat at 1s. 3d. per pound to pay for one hundredweight of sulphate of ammonia. Thus, taking the average figure of 18.5 lb. butterfat, there are about 9 lb. of butterfat left to meet the costs of railage, cartage, and application. Table 5 shows that there were two groups comprising twenty-four farms with average increases distinctly above the general average, and a third group of twenty-five farms the average of which approximates very closely to the general average increase. Further, Tables 1, 7, and 10 indicate that on good pastures, as represented by high production, the best returns are secured from nitrogen.

It is evident, therefore, that the use of nitrogen on good pasture for the production of early and late grass will pay, even though we ignore the indirect value of out-of-season grass.

USE OF NITROGEN ON DAIRY-FARMS SUPPLYING MILK FOR CONSUMPTION IN TOWNS.

Early spring and late autumn grass is important for those farms milking for "town-supply." Since these farms receive approximately twice as much (per pound of butterfat) for their milk as the farms supplying dairy factories, it is evident that the use of nitrogen on good pastures must be well worth while, and will greatly assist in providing grass well on into the winter and again in the early spring.

EFFECT OF SYSTEM OF GRAZING AND OF NITROGEN ON THE PASTURE COMPOSITION.

No exact data regarding the composition of the various pastures under trial are available, but it is agreed generally that the system of management has resulted in improvement of the pastures. Although a number of the nitrogen fields showed a reduction in the amount of white clover at certain times of the year (in the summer particularly) an improvement in the vigour and density of grasses was fairly general. This was most noticeable in connection with rye-grass in the spring and autumn. The effect of the reduction of clover has been commented on earlier.

EFFECT OF SULPHATE OF AMMONIA ON ACIDITY OF SOIL.

It is recognized that the use of sulphate of ammonia increases the acidity of some soils. Pierre (W. H. Pierre, *Journal of Soc. of Agronomy*, Vol. 20, No. 3) found that each hundredweight of sulphate of ammonia used on the soils on which he worked required 1.2 cwt. of precipitated calcium carbonate to correct its acidifying effect. Assuming this to be equal to about $1\frac{1}{2}$ cwt. of ordinary ground limestone (the carbonate

content of limestone and the fineness of grinding will affect its efficiency) it is obvious that an extra cost for liming should be charged against sulphate of ammonia. One and a half hundredweights of ground limestone would cost about 1s. 2d. (at 15s. per ton), so that it seems reasonable to add this to the cost of each hundredweight of sulphate of ammonia, even though it is not applied with the ammonia, but as part of a normal lime application.

Pierre also found that high-grade basic slag when used at about 2.2 cwt. to every hundredweight of sulphate of ammonia prevented any increase in soil acidity. It would appear, therefore, that in those localities where basic slag is commonly used because it is as effective or more effective than other forms of phosphate there will be no need to consider the effect of sulphate of ammonia in increasing soil acidity, providing a little more than twice as much slag as sulphate of ammonia is used. Of course, *the two must not be mixed.*

It was further found by Pierre that ammonium nitrate increased acidity, but to a lesser extent than sulphate of ammonia, the former requiring only 0.6 cwt. of precipitated calcium carbonate to neutralize the acidifying effect of 1 cwt. This suggests the desirability of a nitrogenous fertilizer such as nitro-chalk, which is a mixture of ammonium nitrate and calcium carbonate. The carbonate is present in more than double the quantity required to neutralize the acidifying effect of the ammonium nitrate. At present prices, however, 1 cwt. of sulphate of ammonia and 2 cwt. of ground limestone would be slightly cheaper than an amount of nitro-chalk equal in nitrogen to 1 cwt. of sulphate of ammonia.

It should be pointed out that all soils are not appreciably increased in acidity by the use of sulphate of ammonia. Gallagher (P. H. Gallagher, *Journal of Dept. of Agric.*, Ireland, Vol. 29, No. 2) writing on the subject points out that highly "buffered" soils (soils able to resist acidification or alkalinization) are not readily affected by applications of sulphate of ammonia. In regard to the soil on which he worked Gallagher states: "The results show that of itself an annual application of 4 cwt. of sulphate of ammonia could not cause acidification in this soil unless continued for considerably more than half a century."

Summary.

(1) The records of seventy-four trials in the 1928-29 season and eighty-four trials in the 1929-30 season have been examined. Each trial consisted of a pair of fields, one manured with phosphate and the other with phosphate plus nitrogen.

(2) The results of the 1928-29 season showed that an average of 44.5 cow-days per acre, which is equivalent to a gain of approximately 42 lb. butterfat, and also 7.7 dry-stock days per acre were obtained from the use of nitrogen. The average gain for each hundredweight of nitrogenous manure used was equivalent to 13.5 lb. butterfat. (This does not take into account the dry-stock days. See Note 5.)

The results of the 1929-30 season showed that an average increase of 37.6 cow-days per acre, equivalent to a gain of approximately 37 lb. butterfat, and also 2 dry-stock days per acre were obtained. The average gain for each hundredweight of nitrogenous manure was 18.5 lb. butterfat.

The average increase for each hundredweight of nitrogenous fertilizer applied in late winter was 20 cow-days per acre. The average increase for each hundredweight of nitrogenous fertilizer applied in the autumn was 13.3 cow-days per acre.

(3) It has not been possible to estimate the effect on subsequent production of milking-cows of having early "out-of-season" grass. It is agreed that this effect may be considerable.

(4) A dressing of nitrogen in July or August is considered more profitable than dressings at any other time of the year, although a dressing in March or April produces valuable extra feed in late autumn or early winter. In the North Island indications are that July dressings are more efficient than those applied in June or August, except perhaps in the colder districts such as the Wairarapa, where August application may be early enough. This also applies to the South Island.

(5) An application of nitrogen in July will, on a good grass-sward, give feed a fortnight to a month earlier than usual.

(6) On some trials the effect of the July application has been continued through the summer, in others the effect has disappeared with the advent of dry conditions.

(7) Pastures of naturally high production and containing a fair amount of the better grasses, especially rye-grass, have responded better to nitrogen than fields of lower production, which were generally deficient in the better grasses.

(8) Nitrogen appears to have given better results when the phosphatic dressing was applied at the time, or within a few weeks, of the early nitrogen application.

(9) Errors associated with the trials are discussed.

(10) The economic aspect of the returns is discussed with reference to "out-of-season" grass.

(11) Mention is made of the general effect of the system of management and of nitrogen on the pasture.

(12) The question of effect of sulphate of ammonia on soil acidity is discussed.

The Department's thanks are due to those farmers who co-operated in these trials. Space does not permit of the names of farmers and the results of individual trials being published in detail. To Imperial Chemical Industries for the donation of nitrogenous fertilizers, and to their representative, Mr. R. Lindsay Robb, for his advice and assistance, thanks are also due. The various Instructors who supervised the trials in their respective districts deserve full credit for successful accomplishment of the work over the past two years.

A. W. Hudson, Crop Experimentalist.

J. W. Woodcock, Assistant Crop Experimentalist.

Ridding Lawns of Worms.—Experiments conducted by a Fields officer at Dunedin for ridding lawns and bowling and putting greens of worms show that a solution of 1 lb. of copper sulphate in 12 gallons of water is most effective when watered on a damp day. This mixture, while it kills flat weeds, does not affect the grass.

MORTALITY IN STONE-FRUIT TREES IN HAWKE'S BAY DISTRICT.

N. J. ADAMSON, Orchard Instructor, Hastings.

AN unusual and severe "die-back" of stone-fruit trees occurred in the Hawke's Bay District at the beginning of the current 1930-31 season. The trouble was experienced chiefly in the younger orchards, where trees affected ranged in age from newly planted to four and five years planted. Peaches, plums, and nectarines were affected in a similar manner, nectarines invariably suffering to the greatest extent.

Following the bursting of the buds and the commencement of growth, laterals and leaders died back rapidly, and small cankers formed about the buds along the whole length of the previous season's growth, resembling in a marked degree a severe attack of brown-rot. A copious gumming occurred throughout the trees affected. Even in the early stages it became evident that a number of trees would succumb to the trouble, as the bark on the trunk and main limbs was already dead and the wood losing sap.

Approximately 300 trees have died, and a greater number have received a severe setback, but are gradually recovering. In such cases new growth has pushed out from the base of laterals and from the base of the tree. Trees which appeared at the time to have a fair chance of recovery responded well to heading-back and removal of laterals.

Specimens of diseased wood forwarded to the Plant Research Station at Palmerston North revealed no parasitic fungi which would cause such a condition. In digging up severely affected trees for the examination of roots a sour-sap condition was plainly evident.

The trouble may be attributed to the particular seasonal conditions experienced. The autumn was excessively dry; the rainfall for the four-months period February to May (inclusive) amounted to only 3.95 in., the average for the same period being 12.87 in. Severe frosts occurred throughout the winter and into the spring. Exceedingly cold and showery weather from the south and west was experienced at the period when stone-fruit trees were coming into blossom and commencing growth.

A survey of the district revealed the significant fact that invariably the trees affected were in orchards exposed to the south and west. In older plantings, and in certain extensions to orchards where good shelter had grown up, the trouble was absent. Although provision for shelter had been made in the younger orchards, it was of insufficient height and too thin to afford protection from cold blasts coming from the south and west.

The dry autumn would probably curtail the supply of stored carbohydrates in buds. Trees lacking the warmth and protection afforded by shelter, and also lacking the necessary latent energy to tide them over till a delayed root-action became normal, would probably suffer from these two devitalizing influences sufficiently to bring about a sour-sap condition.

TUBERCULOSIS OF FARM ANIMALS.*

C. WEIGHTON, M.R.C.V.S., Veterinarian, Live-stock Division, Dunedin.

TUBERCULOSIS is a contagious disease of all domesticated animals and man, caused by the tubercle bacillus, a germ which is responsible for setting up, in almost any part of the body, small areas or specks of inflammation, followed by the formation of tubercles or pimples, by which the disease is readily recognized.

The disease has been known for a long time past, and during last century it was studied by numerous workers, including Pasteur and Chauveau in France and Clark in England, while the bacillus itself was discovered by the German bacteriologist Koch. Koch believed that tuberculosis of cattle could not be transmitted to man, but that his theory was wrong was proved as the result of the research work carried out by Professor Sir John M'Fadyean, late principal of the Royal Veterinary College, London. It is now well known that people can become infected with tuberculosis germs from cattle, and this is an important reason for wishing to have animals free from the disease.

Calmette and Guérin in France are two other workers who have made a special study of the disease, and for a number of years they have been experimenting with a vaccine of the bacillus with the object of making the vaccinated animals immune to the disease—that is, the treated animals can be exposed to infection with no ill effects. Whether the vaccine treatment will prove of value in rendering animals immune to tuberculosis has not yet been definitely established.

As already remarked, all domesticated animals can develop tuberculosis, but the disease is most frequently met with in cattle. The greatest number of tuberculous cattle is to be found among aged cows. In Europe it has been estimated that 30 per cent. of adult dairy cattle are tuberculous, while in Britain during the three years 1926, 1927, and 1928 over 52,000 dairy cows and other bovines were condemned under the "Tuberculosis Order." It is rare to find the disease in a sheep carcass.

The tubercle bacillus is a small rod-shaped germ which is only visible under a high power of the microscope. The bacilli can live outside the animal body for a varying period according to the conditions of exposure, but are readily killed by direct sunlight. In milk tubercle bacilli and most other disease-producing germs can be killed by pasteurization at a temperature of 145° F. for thirty minutes.

Three types of the tubercle bacillus are recognized: (1) The human type; (2) the bovine type—the type which infects cattle, but which can also infect man; (3) the avian type, which causes tuberculosis in fowls and in the horse.

Professor Calmette, of the Pasteur Institute, Paris, a world authority, states that there are only two types of the bacillus—the human type and the bovine type. It is possible that the bacillus undergoes changes as the result of passage through the different species.

*Substance of a radio broadcast lecturette.

WAYS OF INFECTION.

An animal may become infected in the following ways: (1) By inhalation—that is, by breathing in the germs; (2) by ingestion, when the germs are taken in by the food; (3) by wound inoculation; (4) presence of the disease in the newly born.

Among cattle inhalation is the commonest method of infection, as is shown by the large number of cases with lesions or tubercles of the lungs or of the lymphatic glands of the chest cavity. Ingestion is the commonest method of infection in the horse, pig, and fowl. Tuberculosis from wound inoculation is rare. The disease is rarely met with in the newly born animal; probably only one cow in a thousand will give birth to an already infected calf. When the germs of tuberculosis gain access to the animal body they may be immediately destroyed by the powers of resistance of the animal, or they may set up one or more spots of inflammation in the organ which they have reached. If infection is by inhalation the lungs will be affected first.

As a result of the attempt on the part of the white blood-corpuscles to destroy the invading germs, considerable destruction of white blood-cells and of the tissue or flesh immediately surrounding the tubercle bacilli takes place, with the formation of the lesion known as a tubercle, which may later acquire the character of cheese. In cattle these tuberculous nodules or pimples vary in size from that of a millet-seed to 1 in. or more in diameter. A thick yellow fluid exudes from the tubercle on incision. The colour of the fluid varies in the different animals, and the consistence of the contents of the tubercle may alter with the age of the lesion. The tubercle bacilli spread from the inflammatory area by way of the lymphatic system, which is equally as important as the circulatory or blood system. The vessels of the lymphatic system are closely associated with the smallest blood-vessels, and serve the purpose of carrying the necessary energy-giving food from the blood to the muscles and organs of the body. The lymphatic vessels contain white blood-corpuscles.

It is only in advanced cases of the disease that the germs are carried in the blood-stream. When this does occur, tubercles may be found in several organs and in the carcass, the condition being known as generalized tuberculosis. The blood in the veins is generally affected first, and the germ-laden blood flowing to the lungs readily sets up the disease throughout the whole organ. When the blood of the arteries is affected tuberculous lesions or tubercles may appear in any part of the body, such as the spleen, kidneys, brain, and spinal cord, also in bones and joints.

DANGER OF TUBERCULOUS COWS TO MAN.

The possibility of adult people becoming infected with tuberculosis from dairy cows can be stated as small. This can be easily understood because of the small percentage of cows which actually secrete tuberculous milk—probably one cow in a hundred that are tuberculous. Another factor is the higher power of resistance of adults to the disease than children. The greatest danger is to children, particularly if they are not in good health. Many cases of intestinal or bowel infection in children can be attributed to the drinking of tuberculous milk.

While it is easily understood that the elimination of tuberculosis from our herds would be of very great value from a public health point of view, it must not be supposed that all tuberculous cows are a danger in spreading the disease, any more than that all tuberculous people are capable of spreading the disease to others. A small tuberculous lesion, for example, in one of the lymphatic glands adjoining the bowel would be sufficient to make the animal react to the tuberculin test, but during the whole life of the animal it might never prove a danger to other cows in the herd, although the possible danger of a more or less rapid spread to other parts of the body is a point which must be borne in mind.

The most dangerous cows are those which are eliminating tubercle bacilli in their secretions. The tuberculous germs can be eliminated from the body in the milk, and if present in the bowel contents they will ultimately create another source of infection. Tubercle bacilli can be coughed up from the lungs, and can be found in the material which may lodge on the walls or troughs of the cow-shed, on microscopic and biological examination. They may also be spread from discharging tuberculous lesions which have burst through the skin. Cases of tuberculosis of this type are sometimes called "open tuberculosis." This, however, is not a good term, as an animal which has previously passed no germs to the exterior may commence at any time to eliminate tubercle bacilli.

SUSPICIOUS SYMPTOMS.

The following symptoms or signs may lead an owner to suspect tuberculosis in a cow: (1) A persistent cough, especially following exertion; (2) a gradual falling-off in condition for no apparent reason; (3) any swelling in the region of the jaw, in front of the shoulder, in the thin flank, and in the hind leg about midway between the buttocks and the point of the hock; (4) hardness of one or more quarters of the udder, with apparent absence of pain. The condition of the animal, especially in the early stages of the disease, offers no information as to whether the disease is present or not, and cases are frequently met with of very fat cattle showing widespread tuberculous infection on post-mortem examination.

The milk of a cow suffering from tuberculous mastitis may appear quite wholesome to the naked eye, and in this respect it differs from the milk of a cow suffering from an acute inflammatory mastitis—that is, acute inflammation of the udder.

INSPECTION SAFEGUARDS.

The following methods are adopted in New Zealand by the Livestock Division of the Department of Agriculture for minimizing the danger of tuberculous infection to man:—

(1) Meat-inspection: All cattle and pigs slaughtered in the abattoirs are thoroughly examined by the Meat Inspectors of the Division, and in this way any tuberculous meat is prevented from being passed for human consumption. A system of inspection is in operation whereby the organs of the body are examined and certain glands of the organs incised, while the chief groups of lymph-glands of the carcass are incised for the detection of tubercles.

(2) Inspection of herds by field officers: The field officers of the Division are constantly inspecting cattle, and all animals suffering

from advanced or clinical tuberculosis are destroyed, while all suspicious cases are submitted to the tuberculin test and are destroyed if they fail to pass the test. By the Stock Act of 1908 and amendments compensation is paid for condemned animals under certain conditions.

(3) Dairy-inspection: All suppliers of milk for direct human consumption are registered with the Department, and every care is taken to ensure that tuberculous milk is not consumed. An Inspector periodically visits these registered suppliers, and an essential part of his duty is the inspection of the herds, in the course of which he has the power to condemn any animal showing clinical evidence of tuberculosis. In the winter months composite milk-samples (that is, samples representative of the herd) are taken from selected herds and subjected to the biological test for tuberculosis, and over the whole of New Zealand it is only rarely that a positive reaction is obtained.

METHODS OF DIAGNOSIS: THE TUBERCULIN TEST.

The disease may be detected or diagnosed by one or more of the signs or symptoms already given, such as a persistent cough or falling-off in condition, while other minor symptoms form a guide to the clinician.

In the early stages, when no symptoms are showing, the disease can only be detected when the animal is submitted to the tuberculin test. Tuberculin is a sterile glycerinated solution of the toxins produced by the tubercle bacillus when it is grown in broth under artificial conditions in the laboratory. The tuberculin is obtained from the broth in which the bacilli are grown by allowing it to pass through a very fine filter, and a 5-per-cent. solution of carbolic acid is then added as a preservative. The presence of the disease renders the animal tissues sensitive to tuberculin, which when injected under the skin of an infected animal causes a temperature reaction.

The test, which consists of the injection of 3 cubic centimetres of tuberculin under the skin, in the neck or shoulder region, is known as the subcutaneous test. The temperature of the cow is taken immediately prior to injection, and at the twelfth and fifteenth hour after. The normal temperature of the cow is 101.5° F., there being a slight variation in the morning and evening temperatures. As the morning temperature of a healthy cow is often slightly less than the evening temperature, a rise in the 6 a.m. reading leads the veterinarian to suspect tuberculosis, and that a further rise in temperature is to be expected at 9 a.m. In many cases there is a definite reaction at the 6 a.m. reading, the temperature being as high in some cases as 105° to 106° F. Sometimes a healthy animal will show a slight rise in temperature due to excitement or to digestive or respiratory disturbance. Very great care has therefore to be exercised in forming an opinion as to whether an animal has definitely reacted or not, and due consideration must be given in all cases to the thermometer reading when the evening temperature is a little above normal. Should the evening temperature be too high it is not considered advisable to proceed with the test.

By making a careful examination of the cows at the time of taking their temperatures and giving them the injections of tuberculin, and

paying strict attention to the thermometer reading, it is highly improbable that anything will intervene in the succeeding twelve hours which will be sufficient to increase the temperature so far as to lead one to suspect the animal to be tuberculous. Should there be any doubt as to whether an animal has reacted, a second test can be applied in two months. It is unsatisfactory to apply a second test too soon.

PRECAUTIONS FOR MAINTAINING A HERD FREE FROM TUBERCULOSIS.

Once a tuberculosis-free herd has been established, the cost of maintaining this herd free is very small, especially where all the cows can be reared on the farm. When the consumer fully realizes that children run no risk of contracting tuberculosis of bovine origin from milk which is obtained from a tuberculin-tested herd a demand will be created for this milk, which will ultimately bring advantages to the producer.

The following points should be noted:—

(1) The farmer should report any suspicious cases to the local field officer of the Live-stock Division.

(2) Where possible all young cattle should be kept apart from the main herd.

(3) The cows should not be allowed to come in contact with other stock.

(4) Cows which are bought to keep up the required number of the herd are a great difficulty. They should be kept isolated until they have passed the test, or they should pass the test before purchase.

(5) The cow-shed should be disinfected periodically by spraying with a solution of 1 pint of crude carbolic acid to 4 gallons of lime-wash.

Many farmers are anxious to have their herds definitely free from tuberculosis; but although a great deal of testing may have been done, and diseased cows eliminated from the herds, they must bear in mind that it is not simply a case of destroying the affected cows, but also of paying strict attention to disinfection of the cow-shed and yards after the diseased animals have been disposed of. As already stated, it is the cow which is passing the germs of infection to the outside that is responsible for spreading the disease to other stock, and where cows have reacted it is advisable to look upon them as having eliminated infective material in the cow-shed, yards, and pasture.

The difficulties of overcoming infection in the paddocks is obvious. Here, however, sunlight plays an important part in destruction of the germs. In respect to the yards all contaminated soil can be turned over, and the cow-shed, particularly the woodwork at the animal's head, can be disinfected, or a brazier's lamp may be used. Where there is no proper trough in front of the cows, and any food that is given indoors is put on the ground before them, there is a great danger of the disease germs collecting at that spot and spreading in the dust from stall to stall.

Following the condemnation of cows in the advanced stage of the disease, disinfection is next in the order of importance, and farmers should give their cow-sheds a thorough cleansing and disinfecting periodically, even though they have no direct reason to suspect disease.

TOE AND TAIL PICKING AMONG CHICKENS.

INVESTIGATIONAL WORK AT WALLACEVILLE.

H. A. KITTO, Overseer, Wallaceville Poultry Station, Wellington.

PROBABLY one of the most difficult problems the poultryman has to face at the present time in connection with the artificial rearing of chickens lies in discovering the cause or causes of chickens acquiring cannibal habits.

With the knowledge now available in regard to the feeding and management of chickens and the simplicity with which brooders can be worked, the causes of most troubles met with in brooder work are now generally known, and if these are discovered and removed nothing more is required, providing, of course, that the chickens are given commonsense treatment. This, however, is not the case in regard to cannibal habits. Few, if any, can advise as to their cause or lay down a definite line of procedure for controlling the trouble, as it is well known that preventive measures which will have the desired effect under one set of local conditions will fail under others.

It is common for a batch of chickens to be all that could be desired in appearance, and from no apparent cause resort to picking each other. This may also happen with healthy, half-grown birds, causing heavy mortality. Usually the parts first attacked are the toes and the root of the tail, and once blood makes its appearance the victim will suffer a cruel death if not immediately removed from the flock. Sometimes a light application of tar or other similar material with an objectionable taste will have the effect of preventing a chicken from being further attacked. Generally, however, any attempt to stamp out the trouble by treating the victims is a weak line of procedure.

In the last batch of chickens hatched during the 1929 season at the Wallaceville Poultry Station toe and tail picking caused considerable trouble, and preventive methods as commonly advised were resorted to. These included an increase in exercising space, the supply of extra green material and animal food—meat-meal being always made available for the birds to pick at—but unfortunately this treatment had little or no effect, as the trouble continued for several weeks. As there was a quantity of oatmeal and rolled oats on hand, and it was considered inadvisable to carry this over till the following season, these foods were fed in excess to the chickens referred to compared with the quantity given to the earlier batches.

On the assumption that the heavy ration of oatmeal and rolled oats may have been responsible for inducing cannibalistic habits in these particular chickens, those materials were eliminated from the ration at the commencement of the 1930 rearing season. As the first batch of chickens thrived and generally did remarkably well, and the birds showed no inclination to pick each other, oatmeal was eliminated from the ration throughout the season, with the result that not a single bird acquired the habit. It is not to be implied that the elimination of oatmeal from the ration was solely responsible for the non-appearance of the trouble, as it is well known that chickens can be

successfully reared when this material is included in the diet. The experience, however, does suggest that oatmeal when fed to excess is probably a contributing factor towards encouraging the habit. During the recent season not only was oatmeal excluded from the ration, but the chickens received a less number of meals than in the previous season. They were kept on the hungry side, particularly during the early stages of their development, and this in itself may also have been a factor in preventing cannibal habits and in the sound development of the chickens during the season, as the deaths from all causes in a total of 1,350 chicks incubated did not exceed 3 per cent.

During the 1930 season the following formula was used for the first two weeks: 30 lb. finely cracked wheat, 16 lb. finely cracked maize, 1 lb. linseed, 1 lb. finely broken oyster-shell, 1 lb. charcoal. After the second week 3 lb. of hulled oats was added to the ration. About one hour before feeding the quantity of the above-stated mixture to be used for the following meal was put into a basin and boiling water poured over it; the receptacle was then tightly covered and the mixture left to swell. This mixture was fed to the chicks four times daily during the first seven days, after which three meals daily were supplied. The morning and evening meals consisted of the grain mixture. At this stage the broken oyster-shell and charcoal were eliminated from the ration and fed in separate receptacles, the material being always available to the chicks. A mixture made up as follows and moistened with milk or water was provided at midday: 2 parts wheatmeal, $1\frac{1}{2}$ parts bran, 1 part finely cut green material, $\frac{1}{4}$ part maize-meal, 2 per cent. meat-meal. Until the chickens reached a stage when they could eat whole grains the latter were broken to a size to suit the age of the birds.

The same mash mixture was used throughout the brooder stage, excepting that the proportion of meat-meal was slightly increased as the birds developed. After the chicks were three days old the first meal consisted of finely cut greenstuff. This was also included with the three grain meals supplied daily, and was also provided in separate form four times a day throughout the brooder stage. Of the various kinds of green material fed, silver-beet proved to be most palatable to the birds. The amount of this material consumed by the birds during all stages of their development was surprising. Skim-milk, when available, or clean water, was always in reach. In substituting cheaper foods for oatmeal and rolled oats a much desired economy in food-costs was thus effected.

Reverting to the matter of cannibal habits, the cause or causes of the trouble, as previously indicated, are still somewhat obscure, and probably it will not be overcome until further investigational work is carried out, resulting in a more standardized method of feeding and general management. With this object further work on these lines will be carried out at Wallaceville during the next rearing season.

Consolidated Ground free from Grass-grub.—The Fields Instructor at Hastings reports that last season several pasture experimental plots, top-dressed in autumn and consolidated through encouragement of stock, were entirely free from grass-grub, whereas the surrounding unmanured paddock was quite eaten out by the grub.

HOUSEHOLD REMEDIES FOR CERTAIN AILMENTS OF STOCK.

W. C. BARRY, M.R.C.V.S., District Superintendent, Live-stock Division, Wellington.

THERE are occasions when the farmer is called upon to employ first-aid treatment in various troubles of stock before expert assistance can be obtained, and the object of the following notes is to outline a few instances in which ordinary remedies, so readily available as to be designated "household" remedies, can be applied with benefit.

Such simple remedies assist nature. The powers of nature in attempting to restore abnormal conditions back to normal are indeed very great. This applies to the animal world in the same manner as to the human subject. Assisted by its adjunct, rest, nature can and frequently does perform wonders. In assisting nature to restore normal functions, simple remedies are very often useful.

SALT (SODIUM CHLORIDE).

Salt is essential for the maintenance of health, and has been used for stock since time immemorial. It is the basis of all stock-licks. The action of salt involves important nutritive functions. It increases the flow of saliva and gastric juice, increasing the appetite and desire for water, which latter is essential to the well-being of stock. Thus, salt in reasonable quantity can be generally regarded as beneficial for horses, sheep, and cattle, and rock salt should be always available for such stock. For pigs, however, it must be used cautiously, for, although small amounts are necessary to the pig's health, this animal is very susceptible to the action of salt, and can easily be poisoned by comparatively small quantities.

In large doses salt is used as a purgative for cattle. Half a pound of Epsom salts with $\frac{1}{2}$ lb. of table salt, dissolved in a quart of water, is less drastic than if the full amount of Epsom salts was given, whereas the desire for water created by the salt assists the laxative action without the weakening effect of the full dose of Epsom salts.

In the condition known as "redwater" in cattle in New Zealand, which is primarily a digestive disturbance, common salt is almost a specific. To begin with, 8 oz. of table salt, with the same quantity of Epsom salts and 1 oz. of baking-soda, is given as a drench dissolved in a quart of water. On the following day, if the condition has not cleaned up, a further dose of 4 oz. of salt with $\frac{1}{2}$ oz. of baking-soda can be administered.

What is known in medicine as "normal saline solution" has many uses. This is made by dissolving one teaspoonful of salt in a pint of water previously boiled and cooled to blood-heat. This solution is cleansing and stimulating to mucous surfaces, and even on wounds has a stimulant and slightly antiseptic effect. This simple solution is often effective as an injection up the nostrils in cases of nasal catarrh of cows.

In cases of sprains in horses, 1 oz. each of salt and nitre, dissolved in a quart of water, makes an efficient cooling lotion applied on bandages to the part.

BAKING-SODA (BICARBONATE OF SODA).

Baking-soda has many uses medicinally. Given internally it is very useful in cases of indigestion, and in that form of indigestion in cattle known as "bloating," in which gases are formed in the paunch, full doses of baking-soda often relieve the condition. In such instances 2 oz. dissolved in a quart of water is frequently successful in dispelling the tympanitic condition.

For calves suffering from digestive disturbance (often caused by stale skim-milk) a teaspoonful of baking-soda dissolved in each feed of milk for a day or two is beneficial. Baking-soda is an antidote to poisoning by any mineral acid. As a first-aid remedy for burns, baking-soda is useful, either in solution or by covering the burnt area with the powder.

MUSTARD.

Mustard is not often given internally, except as an emetic in cases of poisoning in dogs and cats. For this purpose a dessertspoonful of mustard is given dissolved in a wine-glass of water. In the treatment of stomach-worms in sheep mustard is popularly believed to be useful combined with bluestone. Its only action, however, in this connection is that of a stomachic, and it has no effect in destroying the parasites.

Mustard is commonly used externally as a vesicant or blister in the form of a paste mixed with water. Its action here depends upon the amount of friction with which it is rubbed to the part, and the duration of the rubbing. For laryngitis, or "sore throat" in horses this is a popular remedy. Mustard is a good blister to use on cattle, and is commonly employed as a blister to the back and loins of cows down with so-called "paralysis after calving."

TURPENTINE (OIL OF TURPENTINE).

Turpentine has varied therapeutic values. Internally it is very useful in cases of "bloating" of cattle, in doses of 2 oz. of turpentine to a full-grown beast. It is given shaken up in a pint of raw linseed-oil, or in the same quantity of milk if oil is not available.

Turpentine is a much-used remedy for internal parasites. It has a long-standing reputation in the treatment of stomach-worms in sheep, but of recent years, bluestone has been proved to be more effective for this purpose. Turpentine is, however, still given for lung-worm in sheep, and with calves is also useful for lung-worm, more especially if introduced directly into the windpipe.

Externally, turpentine is used as a stimulant, and is usually a constituent of liniments for sprains, swollen joints, &c. A simple liniment is made by shaking up 1 oz. of turpentine in 8 oz. of olive-oil.

STARCH.

Powdered starch is useful as a protective covering for wounds. An antiseptic dusting-powder for wounds is made by mixing equal parts of powdered starch and boric acid. Starch gruel is given internally in cases of scours, and is useful when other medicaments are not available.

SEASONAL NOTES.

THE FARM.

"Strain" in Pasture Establishment.

DURING recent years there have been some considerable changes in the idea of what forms real efficiency in grass-farming—changes which in certain instances have a direct bearing on farm-work that will be done during the coming weeks. One of the most important of these changes is in relation to the constitution of seed mixtures. In general, in the past we have been inclined to focus attention upon the proportion of species in a mixture. Recent field investigations drive home the point that this practice, though sound enough, in itself does not go far enough. It is not enough for the efficient farmer to say that he desires a given weight of perennial rye-grass or of cocksfoot or of white clover in the seed mixtures; it is of the utmost importance that he knows also just what strain of these species is to be used.

The necessity for specific reference to "strain" in this connection arises from the fact that pasture-plants which are in general of the same kind, and to which the same name is applied, differ at times considerably from one another in points that are of great economic importance. For instance, what is known commercially as perennial rye-grass has been shown by field trials to consist both of lines or strains which are so persistent under good grass-management as to justify fully the application of the term "perennial" to them; and of other lines or strains which, when they are not allowed to reseed, die out so quickly as to make the term "perennial" absolutely misleading when applied to them. These latter strains are so far from being perennial that they are not even biennial. To these strains, so definitely temporary in habit, may be attributed much of the deplorable and considerable deterioration which in the past, at times, has rapidly taken place after the establishment of pastures in which a relatively long life with the minimum of deterioration was eminently desirable.

The whole rye-grass strain position may be given its practical application by adopting as a working-rule that, wherever advisable to sow the grass generally known as perennial rye-grass, the seed used should really be perennial in nature, and not perennial in name only. This resolves itself into using rye-grass strains which meet the requirements of the Agriculture Department's system of certification. It can be expected with confidence that when the use of viable rye-grass seed possessing the qualities demanded by the certification system is linked with judicious top-dressing, then premature "running-out" of pastures intended to be of long duration, on land of reasonable fertility, will be a thing of the past.

Strain considerations also already enter into the use both of cocksfoot and of white clover. At the present juncture all that need be kept in mind is that it is better to use New Zealand white clover of superior type and New Zealand cocksfoot than it is to use imported commercial lines ordinarily available.

Purity and Germination in Pasture Seeds.

Farmers frequently fail to inform themselves of the purity and germination-capacity of pasture seeds. Lack of care in this respect is simply and essentially bad business. How bad it really may be was rather well exemplified during the past twelve months, when lines of expensive seed which showed germination-capacities ranging from below 30 per cent. to above 80 per cent. were being sold to farmers at substantially

the same price throughout. Farmers at times purchased these lines merely because of a 5 or 10 per cent. difference in price. Actually certain lines could have been 100 per cent. more costly than others and yet substantially more economical as a source of viable seed. Purity of seed, with particular reference to the content of harmful species, also warrants more attention than it receives. The purity and germination of certified seed call for particular mention because many seem to act on the misconception that seeds which are officially "certified" are, because of that fact, to be taken as quite satisfactory in regard to germination and purity. This is not so. Certification is essentially concerned with strain characters. Really the fact that a line of seed is certified implies nothing in respect to its germination and purity. Certified lines of seed have varied strikingly in germination, while their prices have at times not varied to a corresponding extent. If a farmer pays an unduly high price for certified seed of poor germination, he can blame only his own failure to exercise ordinary business care, for ready means of securing the information he should obtain are available free of cost.

Farmers who are sowing certified rye-grass seed, and who may eventually wish to harvest certified seed from the resultant pasture should acquaint themselves thoroughly with the practical bearing of the differences conveyed by such classifying terms as "mother," "permanent pasture," and "first harvest maiden" seed—terms which are used in rye-grass certification in such a way that they cover differences which might upset the plans of one not aware of their nature.

Pasture Seed Mixtures.

Seed mixtures for different purposes and conditions were dealt with in considerable detail in seasonal notes in the February, 1930, issue of the *Journal*. Readers who desire information of this type and who are not in a position to refer to the notes mentioned should inquire regarding the matters in which they are interested from the officers of the Fields Division in their district.

In the 1930 notes the quantity of seed most suitable for the establishment of a short-rotation pasture of two to three years life is understated. A seed mixture which gives good results in the sowing-down of an acre of such pasture contains: Italian rye-grass, 15 lb.; perennial rye-grass, 15 lb.; red clover, 4 lb.; and white clover, 2 lb. The pastures resulting from the use of such a mixture serve a useful purpose mainly on farms on which, principally because of climatic conditions, cereals and special crops rather than pastures are the dominant features. On such farms short-rotation pastures, while giving the land a beneficial rest from cultivation, at the same time produce heavily during their short life, and fit in well with farm-work generally.

There is one aspect of pasture-seed mixtures which was not fully dealt with in the February, 1930, notes and which is worthy of some discussion. This aspect is summed up in the question, What should be the objective? A sward in which perennial rye-grass and white clover are the dominant constituents has been established as the peak of pasture excellence. From this some conclude that the creation of a perennial rye-grass-white clover sward is being recommended as a fairly general objective. Those who have reached such a conclusion are necessarily somewhat puzzled to find that such grasses as cocksfoot, dogstail, and timothy, receive so much attention in the mixtures which are being recommended. The essence of any confusion that exists comes from the fact that the creation of rye-grass-white clover swards is not being generally recommended. It may be granted that, under the conditions which suit it all the year round, a rye-grass-white clover

sward would excel in yield. But such a sward represents the ideal, and what is ideal is not always economically practical or desirable. The areas which are, all the year round, suited for good results with ryegrass are very restricted in size.

This brings up the importance of the word "dominant" as used above. What is being recommended for extensive, comparatively fertile areas is not a ryegrass-white clover sward, but one in which ryegrass and white clover, while dominant, are in association with other species, such as cocksfoot, which are characterized by considerable growth during periods when the growth from ryegrass and white clover is relatively low, and which, further, are present in sufficient numbers to provide a substantial modicum of feed during such periods. Hence it is desirable to include a substantial amount of cocksfoot in seed mixtures for that considerable area of country which, though really good, is yet not quite good enough to justify dependence on a pure ryegrass-white clover sward.

Another aspect of importance is the rôle top-dressing may be made to play in determining the sward produced from any seed mixture. The inclusion of cocksfoot and other grass not demanding the same good conditions as does ryegrass may be looked upon not at all as antagonistic to the objective of a ryegrass-white clover dominant sward. Top-dressing may be employed to bring the fertility up to the ryegrass-white clover requirements; when the conditions are favourable to the growth of the ryegrass and white clover the others will not assert themselves; when the conditions are unfavourable to the ryegrass-white clover association the others will usefully take up the running. By doing this they will facilitate rather than hamper good grazing management.

General Management of Pastures.

Because of the present financial position some farmers may be contemplating the elimination of late summer and autumn top-dressing, despite the fact that its outstanding value is beyond question. At a recent conference representative of the grass-farming investigators of the Dominion the economic merits of late summer and autumn top-dressing with phosphates were unanimously agreed to, and it was pointed out incidentally that extensive inquiries disclosed that pre-winter phosphatic top-dressing reduced the maintenance cost of butterfat-production—that is, the cost of production exclusive of interest and labour charges. The decision of the conference confirmed the advice recently given in these notes, and stressed the need for endeavouring to avoid neglect of top-dressing under the present difficult conditions. In particular, top-dressing of young pastures should not be neglected; judicious top-dressing in the early stages tends to foster vigorous establishment, particularly of the better species, and to prevent undesirable species gaining an initial ascendancy which would lead to rapid deterioration of the pasture as a whole—deterioration which it would be difficult and costly to remedy subsequently.

In March, in districts where a fair amount of rain may be expected during the month, topping with the mower may be advisable to effect the removal of tall rough patches of growth. The removal of such growth favours the development of valuable fresh leafage, which would not be so readily produced if the patches received no attention.

Harrowing of pastures during March is often distinctly valuable, particularly because it distributes accumulations of droppings which have been carried over from the earlier drier period. Two strokes of the harrows, one at right angles to the other, are much more effective for this work than a similar amount of harrowing done by travelling over the paddock in any other way.

Seasonal Cropping Work.

A weak feature of New Zealand farming is inadequate provision of feed for the late winter and early spring period. One result of this is the exceptionally good returns usually obtained by the farmer who, through making specially heavy winter feed provision, is in a position to increase his stock prior to the critical winter period when others are desirous of selling, and who thereby exploits the common weak feature of our farming. The winter feed position should be considered at this season, because, if necessary, crops may with advantage be sown in March for the provision of winter and spring feed.

Among the suitable crops are: Algerian oats, about $2\frac{1}{2}$ bushels to the acre; Algerian oats, $1\frac{1}{2}$ bushel, and Western Wolth's rye-grass, 1 bushel; Black Skinless barley, $2\frac{1}{2}$ bushels. All of these crops will usually respond profitably to a dressing of 1 cwt. to 2 cwt. per acre of superphosphate applied at the time of sowing the seed. In the preparatory cultivation for autumn-sown crops the production of a fine surface layer of soil is not altogether desirable; such a layer is very apt to set into a hard surface, particularly in soils containing a substantial amount of fine silt or clay. Fine soil below the surface to form a good seed-bed is certainly desirable, but small clods on the surface are perhaps an advantage rather than a disadvantage, for, as a rule, eventually they will weather down during the winter into a desirable tilth.

If land which has grown cereals or soft turnips is to be put under the plough again, it is generally advisable to proceed with such cultivation work as soon as practicable after the land has become unoccupied. At times such land is too hard for satisfactory skim-ploughing. If this is the case, cultivation with the disks set with plenty of cut is a serviceable alternative to ploughing.

Arrangements should be made to utilize crops of maize, millet, and sorghum before frost injury may reasonably be expected. Any portion of such crops which cannot suitably be utilized as green feed should be made into silage, provided there is about 25 tons of material available for this purpose. If the amount of surplus crop to be saved is insufficient to justify ensilage, then millet and sorghum may be made into hay; but it is well to remember that it is somewhat difficult to dry safely the relatively coarse stalks of these crops. Even though ensilage may mean relatively heavy wastage because of the limited amount of material, and haymaking may present difficulties, yet it is, as a rule, better to adopt one or the other than to allow the remnant of the crop to become a total loss because of frost injury.

Lucerne Management.

During March lucerne fields usually provide a cut which should be used for hay or for green feed according to the feed position on the farm. Especially when grass growth has been allowed to become dry and woody, green lucerne proves a valuable supplement to the pastures. When pastures are bare green lucerne may be fed in conjunction with soft turnips, with probably better results than would be obtained from feeding either crop separately. If the feed that green lucerne is supplementing is woody it is especially desirable that the lucerne be used at a young fresh non-woody stage. This means it should be cut before flowering has at all advanced.

If lucerne is infested with weeds and the conditions are dry, it may be advantageous, after a March cut has been removed, to cultivate the stand with the tine harrows. However, it is well to remember that probably more harm than good is done throughout New Zealand by surface tillage of lucerne. This happens because frequently if tillage is

sufficiently severe to destroy the invading weeds it will also be so severe that it will necessarily reduce the number of lucerne-plants, and if persisted in will lead to thinning out of the crop to a harmful extent. The best policy in respect to weeds is to put the lucerne in an offensive rather than a defensive position; this means that the conditions should be made so good for lucerne in respect to fertility and management that the tendency is for the lucerne to kill the weeds rather than for the weeds to kill the lucerne. However, should weeds have gained such a hold that cultivation is necessary, then implements with narrow-pointed tines should be used in order to minimize the injury to the lucerne. In the case of crops growing on somewhat friable soils, good results have been secured when harrowing of the lucerne in March has been followed by the sowing of a light seeding of Italian rye-grass or Algerian oats. If this is done one must be prepared also to cut the resultant growth early in the spring for green feed or silage, otherwise smothering, which weakens the lucerne, is apt to occur.

—R. P. Connell, *Fielas Division, Palmerston North.*

THE ORCHARD.

Export of Fruit.

THIS month fruit-export will commence for the 1931 season, resulting in growers' time and energies being fully occupied with harvesting and packing the crop of apples and pears for shipment overseas. Although many of the difficulties of the past have been overcome, and others only partly dispersed, the main factors, such as care in harvesting, picking at the best stage of maturity, and thorough, careful packing still remain to ensure the best results and returns for the fruit. It will be well at this time to consider some of the weaknesses which are known to exist.

Harvesting.

Fruit is still being picked and left in the sun for considerable periods before being carted to the packing-shed. In one instance last season it was found that apples which had been exposed to the sun in cases in the orchard were registering a flesh temperature of 94° F., while similar fruit still unpicked on the trees gave a temperature of 72°, even though it was selected as that most exposed to the sun. The explanation is that the functioning of fruit which has been picked has largely ceased, with the result that the absorption of heat is not reduced by other influences, while the apples on the trees are being cooled by the action of transpiration and uninterrupted sap-circulation.

Where fruit is picked in the heat of the day it is essential that it be carted to the packing-shed or other shady place to cool off before packing. If picked towards the end of the day it may be left stacked in the orchard with a light covering of weeds or scrim, through which the heat given off by the fruit can rise and disperse.

Select Pickings.

It is now common practice with most of the more efficient growers to make several select pickings of each variety. With the more general use of fertilizers the practice has to a large extent forced itself on the orchardist in order to obtain the colour requirements of the best grades. Whether this is the position or not, many advantages can be claimed for the practice, irrespective of colour. Immediately a tree is relieved of a portion of its crop the effect is to stimulate growth, accelerate the sizing-up of the fruit left on the tree, and also to increase the fixation of colour. To sustain a heavy crop retards the development of these features.

Bruising and Overmaturity.

Bruising is still regarded by research authorities as one of the main factors reducing the market value of transported fresh fruits. The prevalence or otherwise of fungal wastage is largely influenced by the amount of bruising and scratching which fruit has been subject to prior to packing.

Overmaturity is still a drawback to good sales; therefore the period of handling each variety when picked should be as short as possible before shipment, and subsequent control of ripening be taken over by the cool store.

A great deal of scratching and superficial marking was experienced in fruit submitted for examination last season, especially in those packing-sheds in which mechanical graders were installed. The effect of this class of injury is much more serious than can be easily realized by growers. Very little of the injury is apparent at the time of packing, but later these scratches and minor bruises oxidize and discolour, deducting a great deal from the face value of the fruit. It must be remembered that fruit, like most vegetable products, sells very largely on the freshness or otherwise of its appearance.

Most of the grader injury referred to can be avoided by daily scrubbing the rollers and other parts with which the fruit comes in contact with a wire brush. This removes the waxy substance which attaches itself to the grader, and which in turn accumulates and absorbs much of the dust associated with the packing-shed and boxes used in the orchard for holding the fruit.

Packing, Labelling, and Branding.

When packing more attention should be paid to consolidation of the pack at both ends of the box with the hands as the case is being filled. This will tend to tighten up the apples in the centre of the layers, with the result that the fruit in the centre of the case will rise higher than the ends. This is very desirable, and will facilitate lidding without crushing the apples towards the ends of the case, which so frequently is noticed on inspection. It is gross abuse of the product to rely upon the lidder to consolidate the pack.

The need for careful, clean labelling and branding need hardly be stressed. It is sufficient to remind readers that a clean smart package offers the first good impression which the producer has an opportunity of making on a prospective buyer.

—*M. Davey, Orchard Instructor, Mapua.*

Citrus-culture.

Where cultivation has not been carried out in a proper manner during the period of dry, warm weather the trees may have suffered somewhat in consequence. However, now that the soil has received a good soaking in most of the districts concerned, no time should be lost in having this work carried out. It is very essential that every effort should be made to conserve all the moisture possible at this period of the year. Both trees and fruit may suffer if this is neglected. Cultivation must be relied upon to a certain extent to take the place of mulching, as the latter practice is hardly feasible in commercial citrus orchards. If it is possible to mulch, however, and material is available, the grower would be well repaid for the trouble taken.

A careful watch must be kept at all times upon the trees, as there are often minor operations to be carried out of which the grower may not have been reminded previously. It may be that odd trees have contracted some disease that needs attention. Thrips may be in evidence, or even black aphid, as dry conditions favour their operation. A spray of Black

Leaf 40, 1-800, and red oil, 1-50, will check these pests. Both of these materials or either can be added to bordeaux when spraying for the control of verrucosis. The greatest care should be exercised, when spraying for thrips, to cover the under-sides of all foliage, as this is where these insects are usually found.

An application of fertilizer during the ensuing period will be found beneficial. Highly nitrogenous fertilizers should, however, be avoided during the autumn, as they will only stimulate wood-growth, which will not be sufficiently hardened to withstand winter frosts. A moderate dressing of phosphates and sulphate of potash will be all that is required at this period of the year.

—L. Pavnter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Classification of Stock.

OF the many factors contributing towards the successful management of poultry none are of greater importance than the weeding-out of unprofitable stock and selecting the following season's breeding-hens before the moulting process sets in. If this work is to be efficiently carried out it is imperative that the birds be gone through and classified before moulting takes place. At this time of the year certain signs manifest themselves which indicate laying-capacity and constitutional vigour. These signs generally vanish as the moult sets in, and are not easily observed again towards the end of the following laying-season. The hens are now having their final flutter in egg-production, and therefore there is no better time at which to choose the breeders and to discard the drones.

Points in Culling.

In a general way it is a good rule to eliminate the early moulters, and this point cannot be emphasized too strongly. For example, the early-moulting bird would have little chance of winning an egg-laying competition, and it is usually an easy matter to sort out the money-makers from the "boarders." If the first moulters are handled they will be found to be in a heavy overfat condition, as they have been converting their food into flesh and fat—that is, if they are not light through having a weak constitution. The late moulter, however, will be found to be carrying no surplus flesh or fat; she will present what might be termed a lean, hard condition.

When it is considered that the early moulter invariably rests for four or five months before commencing to lay again, it will be seen that the discarding of the drones, which are invariably the early moulters, is imperative in order to secure highly profitable returns. In taking the time of moulting as indicating laying-power (as is the case with any principle connected with the management of poultry) all the circumstances surrounding the stock should be considered. It is assumed that the birds were hatched at about the same time and received uniform treatment in the matter of food and attention throughout the season. If, however, some of the birds in the flock were hatched at a very early stage—say, in July—then they would naturally be early moulters in comparison with birds hatched in, say, October. It may also be pointed out that the older birds in a mixed flock of first- and second-season layers, where the latter were selected the previous season for the reason that they were late moulters, will usually, owing to their shorter season of production, moult later than the pullets which commenced to lay, say, some time in April.

Thus in such cases where the moulting-period is taken as a guide due allowance for the age of the birds must be made when culling, otherwise many of the young birds which it would be profitable to keep are apt to be disposed of, and their older but less profitable mates retained on the plant.

On all well-managed plants a mark or ring is placed on every bird as an indication of its age, whereby the old birds can readily be distinguished from the young ones, and this system obviously simplifies the work of classifying the stock. By this means of marking some poultrymen cull their stock by age alone—that is to say, all birds are retained in the flock until they have terminated their second season of production. This is a weak policy, as in all flocks, however well they may be bred, there will be found undesirable specimens, not only after the first laying-season, but during the early stages of this period as well. In fact, on general appearance alone there are pullets on almost every plant that should be got rid of even before they commence to lay. This is particularly the case with stock possessing weak constitution, the best of which it is seldom profitable to keep.

As previously indicated, it is usually unprofitable to keep birds beyond their second laying-season. However, in the case of an ideal breeding-hen it will often pay well to keep such a bird until she has passed her third or even fourth season of production, providing, of course, her constitutional vigour does not become impaired. It is now generally recognized—and, in fact, it has become an established maxim of the industry—that eggs in good numbers must be produced during the dear season if the business is to be made really profitable. It is also recognized that the winter layers must be pullets bred at the right time and managed in the right way. Obviously it is unwise to have many old birds on the place that make a drain on the profits from eggs produced by the pullets during the dear season.

In addition to being a late moulter, the high-type layer and the one likely to produce well in the future will invariably exhibit at this period of the year a worse-for-wear, shabby appearance. For this reason alone such birds are often discarded by novices. In the case of white varieties the plumage, although tight and dense, becomes more or less ragged and straw-coloured. This is especially so where the birds have free range or where good-sized runs are provided. The head also becomes almost devoid of feathers, a sign seldom or never found in a low egg-producer. This, together with bold prominent eyes, is an undoubted sign of laying-power and strong constitutional vigour. The legs will appear more or less white and decidedly flat, although they may have been very yellow and more or less round during the pullet stage.

The fact of the legs becoming flatter and the colour leaving them is no doubt due to the yellow fat being drawn from them to supply the egg-yolk with its yellow pigment, and therefore the greater the egg-production the greater will be the tax on the fat contents of the legs, and consequently the more flat and bleached they will become. What applies in the case of the legs does so in like degree to the body-skin, particularly about the vent, and also to the beak. It may be mentioned that hens running on a grass range do not usually bleach out to the same extent in the legs as those kept in confinement. It must also be noted that the change of colour which takes place in the parts referred to only applies towards the end of a bird's productive season, for after it has moulted the legs, &c., will regain their yellow appearance, as is the case during the early pullet stage. The condition of the skin surrounding the abdominal region also gives a guide to laying-power. This skin should be soft and flexible to the touch, so as to allow for contraction and expansion in accordance with the bird's

laying-condition. Beware of the bird that is hard and coarse to the touch around the abdominal region, as this indicates that it is converting its food into fat and flesh instead of, as is the case with the good layer, into eggs.

The shape of the bird gives a good indication as to whether it is laying or about to lay. In a bird about to take a natural rest while undergoing the moulting process it will be observed that the abdomen shrinks as well as the comb, and the bird will appear to have much longer legs than when she is in full laying-condition. Then, the width of the pelvic bones, although not an indication of laying-power, gives a good guide as to whether a bird will lay in the near future, or whether she is taking the usual rest before moulting. If the bones are close together and the breast close up to them it is a sure sign the bird will not lay for some time. On the other hand, if the pelvic bones are well apart, so that they will admit, say, three fingers, and there is a good distance between these and the breast-bone, and the abdomen is full and soft to the touch, it may be taken for granted that the bird is laying or will soon commence to lay, and is therefore well worth retaining in the flock until she shows signs of moulting.

Summarizing the foregoing points, the birds that it will usually pay to cull out are those that show signs of early moulting; those with well-kept plumage, and which are above the normal weight of their breed; those with hard development surrounding the abdomen; and those with points indicating a weak constitution, such as dull sunken eyes, heavy well-feathered eyebrows, bright-yellow legs, loose feathering, and sluggish appearance.

Selecting the Breeding-hens.

Having discarded the poor layers from the flock, the next important step is selecting the prospective breeding-specimens from the remaining flock. While the late moulter is always the best layer, the fact should be remembered that the best layer is not necessarily a desirable bird to breed from. The good layers should certainly be selected to breed from, but in addition they should have the happy combination of desired size and breed character, dominated by the vital requirements indicating undoubted constitutional vigour. It is not uncommon for an undersized, racy-looking bird, with no special type, to be a heavy producer and a late moulter, but to breed from such stock from generation to generation would be simply courting disaster. In breeding the general tendency is to lose in weight of stock; hence if a desired size is to be maintained it is imperative to choose for the breeding-pen the hen of a larger size than that of the ideal laying-weight. Even when this principle is practised a certain number of small birds will always come to vex the breeder. It should never be forgotten that it is a simple matter to reduce the size of stock, but once it runs down it is very difficult to increase it without introducing coarseness.

The selected breeding-birds should be placed by themselves and marked with leg-bands. On no account should they be forced for egg-production. In fact, it is a good plan to retard this, by such means as supplying a plain diet, or a change of diet or quarters. This will give the birds an opportunity to recuperate before being called upon to produce eggs for the renewal of stock. If every available egg is forced out of them they have not the power to impart to their offspring the necessary vitality that heavy egg-production demands. This recommendation, however, does not apply to the ordinary flock. These birds should be forced for egg-production until the laying-season is completed.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Final Extracting.

BEFORE taking the last of the surplus honey a careful examination of the colonies must be made in order to ascertain the amount of stores available for wintering the bees. Too often beekeepers err in extracting too closely, and feeding has to be resorted to at a later period to make up the amount required to prevent starvation. It takes 30 lb. of honey to winter an average colony successfully, and if this amount is increased to 40 lb. there is less likelihood of the bees being short in the spring, while the beekeeper will also be saved a great deal of anxiety and endless trouble in the way of feeding.

Where extracting has been delayed for any reason it is advisable to use great caution in removing the honey. The combs should be removed as expeditiously as possible, and care must be exercised not to incite the bees to rob by keeping the hives open longer than is necessary for removing the surplus. A hasty examination of the brood-chamber should be made if it is found that the bees have not filled the combs in the lower storey with honey. If empty or partly filled combs are found, it is highly important that they be replaced with good combs of honey from the super. On no account attempt to extract any honey from the brood-chamber. Do not leave combs lying about or expose vessels that have contained honey. Unless caution is exercised in regard to these details, when the final extracting is being done the beekeeper is more than likely to start the bees robbing in a wholesale manner.

Bee-escapes.

For removing honey late in the season the beekeeper may find it necessary to bring into use bee-escapes. These escapes enable the honey to be removed without causing any disturbance. By the employment of the Porter bee-escape there is less likelihood of causing robbing, with its attendant evils. More especially will the escapes be found advantageous when removing section honey from the hive. There is far more risk in removing comb-honey than extracted honey. When the colony is disturbed the bees will at once start to fill their sacs, and often the cappings of the sections are punctured in order to secure a supply of honey. The damage to the cappings of sections is unsightly, and causes the honey to leak after removal from the hive.

The escapes are fitted to a board of the exact dimensions of the hive in use. In inserting the board, gently prize up the super from the brood-chamber and insert the board. A puff of smoke will suffice to control the bees while the operation is being performed. If this is done late in the afternoon the bees will pass through the escape during the night to the brood-nest, and will be unable to return. In the morning the supers may be removed, when practically no bees will be left in them.

A word of caution to those who have not formerly used the escapes: Should there be brood in the super-combs the bees will not leave, and the escapes will not prove effective in ridding the supers. Over and over again many beginners complain that they cannot get the bees to leave the supers when using escapes, but the reason lies in the fact that no examination had been made to ascertain beforehand whether the super contained honey only.

Uniting Colonies.

Among the autumn work to be attended to is the examination of the colonies for the purpose of ascertaining if each possesses a laying queen, and to note those that are too weak to survive the winter. In the negative in either case it is advisable to unite with a stronger colony to save the

bees. On no account should an attempt be made to winter weak colonies, as they are likely to get robbed out, and this may cause the bees to start robbing when everything in the apiary should be quiet. A simple method of uniting may be practised by placing the weaker hive on top of a stronger one, and placing a sheet of newspaper between the two hive-bodies. In the course of a few days the bees of the weaker colony will gain their way through the paper and unite peaceably with the bees in the stronger hive. The surplus combs may subsequently be removed and reserved for spring feeding if required. It is advantageous to destroy the queen in the weak hive prior to uniting.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Setting-out Strawberry Plants.

IN the warmer parts of the Dominion, where strawberry crops are grown on heavy land with a good rainfall, it is customary to set out the young plants in the month of May, crop them during the following summer, and then plough them in and replant. This unorthodox system is expensive and laborious, but under good management it is profitable. It is contended that earlier planting is not advisable, and that the land is unsuitable for carrying the plants on for three or four years at a profit. A few growers there may qualify this statement, but it is generally accepted about the Auckland District. That these plants come to maturity earlier in the warm localities and are comparatively short-lived is perhaps not altogether surprising; but in other districts, and especially in the coldest, it is desirable to set out the plants as early as possible in the autumn, so that they may become established before winter sets in, and so make a good start the following spring.

Good crops of this kind are often found on land that is not naturally rich, but never are they profitable on land infested with weeds, especially such persistent kinds as twitch, &c.; also, like many other moisture-loving plants, they demand good drainage. Land from which an early crop of vegetables has been removed will probably now be available. Assuming that it is in very fair condition generally, a good dressing of bonedust should be applied and turned well under. Harrow, smooth, and consolidate the ground; then mark it off in rows 30 in. apart and set out the plants. Common faults are to plant high and lightly. The plants should be set rather low, and the ground well firmed round them after. Where the one-season cropping system is practised, the plants are generally set about 9 in. apart in the rows, but in other instances 12 in., and even more in the case of vigorous sorts. Other necessary conditions are strong plants of a good cropping strain of a suitable variety. These plants, like many others, are inclined to "run out" unless careful selection is practised.

Bush Fruits.

Where bush fruits are to be planted during the coming planting-season—May to August—similar preparation is necessary. All plants of this class have fibrous roots that grow just beneath the surface, so that deep cultivation is not possible after planting is done, and weeds are only eradicated with difficulty. For these reasons the grower makes every endeavour to clean the land before planting, to subsoil the land, and deepen fertility. If the bushes are then suitably planted the superficial cultivation and manuring, which alone are then possible, are

sufficient to keep the crop in good condition for many years. If satisfactory preparation cannot be accomplished in time for planting this season, do not hesitate to postpone it.

The Glasshouse and Outside Tomato Crops.

In the heated glasshouse the second crop of plants in pots will now be under way. Too much heat and insufficient ventilation are the two most likely dangers which threaten this crop—so difficult is it to understand that a good thing can be overdone. If the house is kept at a temperature of 55° to 65° F., and the plants are supplied with water at a similar temperature, there should be little trouble so long as the atmosphere is reasonably dry. It should be realized that growing plants give off from the foliage a quantity of moisture into the air, more or less according to their size. A tomato-house with the crop half-grown, or bigger, very soon becomes atmospherically humid to excess, and the crop is reduced to an unprofitable condition from which it is very difficult to recover. This is prevented by leaving on sufficient ventilation to allow the moist air to escape, at the same time maintaining the temperature by fire heat. The danger is not great until the plants are half-grown, when close attention is necessary to set the upper bunches of fruit and defer the attack of leaf-mould.

In the unheated greenhouse the harvest will now be about finished. When completed the house should be thoroughly cleansed without delay, and sown down in a green cover-crop. In lifting the old plants and taking them out and burning them, observe their condition and make a note of their troubles, so that suitable steps may be taken in cleansing the house or soil. The ease with which good crops are often grown in new houses is largely due to the fact that they are clean.

The tomato crop outside has a harvest spread over as long a period as possible—that is, as long as the frosts will allow. This is done by delayed planting on certain areas. Towards the end of the harvest it is sometimes worth while fighting the adverse conditions which threaten to close it. For instance, with the remains of a good crop on the vines, and a satisfactory market demand, it may pay to fight the frosts with heaters. Again, outside temperatures late in the season are often insufficient to finish the fruit nicely, and it is an advantage to have an airtight chamber on the premises in which the packed fruit may be placed to complete the ripening process. How far it will pay to make use of these methods will depend on circumstances—on the farm and in the market.

The Market Garden.

Considering all the risks, it is in most instances advisable to harvest crops of potatoes and onions as soon as they are mature—that is, as soon as the potato-shaws turn colour and the onion-plants fall over. Especially does this suggestion apply in the moister districts. Under such conditions the first fine weather should be chosen for lifting these important crops. After allowing the potatoes to lie exposed for a few hours they should be gathered, and in doing so a simple system of grading should be carefully applied. Do not allow the tubers to remain exposed overnight—in dry weather especially—as the potato-moth is then flying, looking for potatoes and plants on which to lay her eggs. These on hatching become caterpillars, which burrow in the flesh of the tuber. When numerous they do great damage, which perhaps is not discovered until some months after the potatoes were bagged up in an apparently sound condition.

Pumpkins should also be gathered as soon as they are ripe, and stored in a dry, airy place. Vegetable marrows are preferred in a fresh state, and should be cut and marketed so soon as they are a moderate handy size.

One is sometimes recommended to thin out the spinach crop so soon as it is big enough to handle, but it is hard to see any advantage in carrying out that laborious task. The commercial method of sowing thinly and harvesting the crop by cutting the plants off slightly below the crown of the root is satisfactory, both in the quantity and quality of the crop.

Towards the end of the calendar year the supply of home-grown onions is often scarce, and large supplies are imported and sold at good prices. Much of the demand at that period would be best supplied by sowing now a suitable variety of the Tripoli type. These mild onions make rapid growth as soon as spring arrives, and are valuable for the making of summer salads, as well as flavouring soups. In the wetter districts it is also customary to sow now the main onion crop for planting out in July, and so obtain early maturity. This means that the bulbs are well advanced generally before mildew disease is prevalent, and they ripen at a season when the dry weather so necessary for proper curing may be expected. In the dry climate of Canterbury this precaution is unnecessary, and spring sowing is usual for the main crop.

The Homestead Garden.

Grass lawns, like other crops, are greatly benefited by the application of suitable manures. A thick, smooth, bright green turf is very uncommon in nature; it is found on a rich light soil, in areas of good rainfall, and where the turf is well grazed by such close-biting stock as sheep. Such an admirable feature is deservedly popular, and is not the least attractive part of the home garden. There are two periods of the year when growth abounds—during the spring and autumn months. At the beginning of each of those seasons is a very suitable time for such attentions as weeding and manuring lawns. If the lawn is rather weak and weedy it could be given the attention now with great benefit.

The usual method where the lawn is large is to lay the garden-line parallel with one of the sides and about a yard distant and carefully remove the more troublesome weeds. By using a second line when the first strip is done, one forms a second, and proceeds as before; and so, with the use of the lines to focus attention, the whole area is covered.

After suppressing the weeds a dressing of fertilizer should be given; 1 oz. of superphosphate, or 2 oz. of basic slag (or the same amount of bonedust) to the square yard would generally be very suitable. The material should be broken down quite fine and mixed with two or three times its weight of sand to enable an even distribution to be made. By passing the mixture through a fine sieve it is thoroughly blended, and rough material may be discarded.

The three to four months we speak of as the planting-season commences with the month of May. It is an important period for any one who has planting to do. Selection and arrangement have to be decided for results and effects which will extend over a long period. Such pioneering is rather a responsible job. Some settlers can daily invoke blessings on their predecessors because of the fine shelter, fruit, and ornamental trees that make the farm comfortable and attractive for man and beast. If one's own enjoyment and profit is to be secured, and that of one's successors, any planting to be done must be well thought out, after reading and inquiry and the assistance of those who specialize in the work. If we make the best use of the experience acquired during the eighty or ninety years these islands have been settled (by the pakeha), a very great improvement and profit should be obtained from present and future planting. But one must study carefully past experience, avoid its failures, and extend its successes.

In many of the warmer districts a number of fruits thrive that should receive more attention from those planting the homestead garden. The

feijoa of South America has been proved to thrive in such localities, and this handsome evergreen with interesting flowers and very fragrant fruit should be given a place. In a natural state it grows as a shrub to a height of 12 ft. to 15 ft., but it makes an excellent hedge without losing its attractive features if it is carefully managed.

In localities such as Wanganui and Tauranga the avocado has been proved to be satisfactory in sheltered positions and on good land. It is a handsome evergreen, carrying pear-shaped fruits which have been aptly described as vegetable butter. It is something quite new in the way of fruit, very wholesome, and does not cloy.

A settler in the Bay of Plenty lamented the fact that he could not grow figs such as he grew in his native country. He was taken to a garden ten miles away, and received a pleasant surprise when he was shown a fig-tree carrying a heavy crop of fruit that was both handsome and delicious. This deciduous tree is little troubled with disease or pests, but it is, of course, necessary to select a suitable variety. A good selection is now available in nurseries where fruit-trees are grown. As an avenue, a specimen on the lawn, or in the shrubbery border this tree thrives well, for on good land it demands very little cultivation.

A problem for the consideration of the planter in the ornamental section is to have the garden really interesting at all seasons of the year. Summer has its attractions in abundance; spring and autumn are well provided with plants of delicate or gorgeous appearance; and during the winter we are accustomed to a tradition that is somewhat bleak and bare. But we are gradually realizing that this is quite unnecessary here, and nature is prepared to be more generous. Autumn flowers and those of spring already meet and may be seen together; but certain sections of the garden are dull too long—the rose-garden, for instance. In the home-stead garden, where results must be obtained rather easily, nothing would perhaps provide the desired effect better than an enclosing hedge of camellias or *pyrus japonica*. The camellia is commonly seen stunted, dry, and sunburnt; but in a rich, moist soil and partial shade it is quite a different subject; and the single and semi-double varieties acquit it absolutely from the charge of stiffness. *Pyrus japonica* is a well-known deciduous shrub and very popular, but the white, pink, and orange-coloured varieties are more rarely seen. Planted about 2 ft. apart and carefully pruned, either the evergreen camellias or deciduous "*japonica*" would make a hedge about the rose-garden that would be very attractive in winter, and a suitable shelter and background for the roses in summer. Such hedges as this that are to blossom must not be grown too thick, or the surface trimmed smooth with shears. They should be carefully pruned with secateurs if the best results are to be obtained; but the hedges should still be shapely and level.

—W. C. Hyde, *Horticulturist*, Wellington.

Storage of Sodium Chlorate.—The Chief Inspector of Explosives, to whom an inquiry from a correspondent was referred, advises that there is no danger whatever and no precaution needed in storing sodium chlorate in a general warehouse in the original iron drums in which this commodity is imported, so long as the packages are intact. In regard to another question as to whether it would be safe to store sodium chlorate in a properly constructed petrol store in which petrol is also stored, the Inspector states that it is not advisable to store sodium chlorate where petrol is stored, for the reason that in the event of fire the presence of the sodium chlorate would greatly intensify the fire. He adds that it is only by heating or friction that sodium chlorate becomes dangerous.

WEATHER RECORDS: JANUARY, 1931.

Dominion Meteorological Office.

CONDITIONS as regards crops and pastures underwent a considerable improvement during January, owing to the increased rainfall. Even where the total precipitation was below the average, and the soils are deficient in moisture, considerable relief was brought by the general rains which accompanied several of the storms. On the whole the month was very stormy and wet. There was an unusual persistence of strong north-west or westerly winds, such as are usually characteristic of the late spring months. Temperatures were below normal, especially in western districts.

Rainfall.—The month was a very wet one for most of the western districts, but particularly so on the west coast and the high country of the South Island. In southern Westland it was perhaps the wettest January on record. Several stations recorded over 40 in. Less than the normal fall was experienced in the northern part of the Auckland Peninsula, the eastern side of the Coromandel Peninsula, from the eastern portion of the Bay of Plenty down the east coast of the North Island to Hawke's Bay and the Wairarapa, in North Canterbury, and on the Canterbury Plains. Everywhere else the rainfall was in excess of the normal, and in most places markedly so.

Temperature.—Except in the northern and east coast districts of the North Island, temperatures were below the previous average. Owing to the Föhn effect (or warming of the westerly winds as they crossed the ranges) eastern districts generally were, relatively, considerably warmer than western districts. At Wellington and on the west coast of the South Island the amounts by which the mean temperature fell below the January average have seldom been exceeded. A few frosts were experienced during the month, one on the 17th at Christchurch being the severest ever recorded in January.

Storm Systems.—As would be anticipated from the foregoing remarks, weather of the westerly type prevailed throughout the greater part of the month. There were a number of rather severe depressions, and most of them were accompanied by several "secondaries." Anticyclones, on the other hand, passed mainly to the north of New Zealand. Consequently, though there was much fine weather with hot and dry winds in eastern districts, in those with a westerly aspect fine spells were few and of short duration. The month was generally regarded as a very unpleasant one for the time of year.

Depressions of the westerly type and of considerable depth passed on the 3rd, 7th, 9th, 15th, and 19th–21st, each bringing rain to the greater part of the Dominion, with many heavy falls. On the 3rd north-westerly gales were experienced at many places, being particularly severe in Wellington and Canterbury.

On the 12th a moderate cyclone crossed the South Island, bringing heavy rain, especially to the North Island. South-westerly gales followed on the 13th. Again, in the depression of the 21st, a slight low-pressure centre developed, this time crossing the North Island, where there were many very heavy rainfalls.

The last depression also was cyclonic, and crossed the South Island on the 27th. The most general rains experienced during the month were associated with this depression, particularly on the 27th. As the storm passed eastwards, southerly gales and cold weather prevailed between the 28th and the 30th. On the 28th there were severe hail-storms in the Nelson district, and a small tornado occurred at Riwaka.

RAINFALL FOR JANUARY, 1931, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitaia	1·82	10	0·58	4·36
2	Russell	3·06	11	1·23	3·48
3	Whangarei	6·58	12	1·71	3·84
4	Auckland	7·38	14	3·69	2·61
5	Hamilton	..	..	..	3·70
6	Rotorua	4·72	8	2·27	4·04
7	Kawhia	7·73	16	2·14	3·24
8	New Plymouth	5·64	17	0·82	4·25
9	Riversdale, Inglewood	12·98	18	2·49	7·36
10	Whangamomona	10·73	12	2·19	5·33
11	Eltham	..	..	..	3·47
12	Tairua	2·60	9	0·94	3·87
13	Tauranga	4·73	8	2·36	4·11
14	Maraehako Station, Opotiki	1·74	11	0·40	3·70
15	Gisborne	0·96	4	0·55	2·77
16	Napier	1·08	6	0·49	3·02
17	Taupo	3·82	11	1·53	3·36
18	Hastings	0·84	7	0·63	1·99
19	Taihape	4·49	19	1·66	3·13
20	Masterton	1·87	13	0·30	2·55
21	Patea	6·03	18	0·86	3·46
22	Wanganui	4·29	16	0·90	2·79
23	Foxton	3·42	13	1·10	2·09
24	Wellington (Karori Reservoir)	3·62	13	0·66	3·16
<i>South Island.</i>					
25	Westport	14·44	23	2·00	8·20
26	Greymouth	15·21	22	2·55	9·27
27	Hokitika	16·31	22	4·01	9·82
28	Ross	24·01	21	4·58	11·59
29	Arthur's Pass	44·10	19	6·50	10·66
30	Okuru	18·29	19	3·36	12·26
31	Bainham	20·40	19	3·75	9·66
32	Nelson	2·77	14	0·88	2·74
33	Spring Creek	2·35	10	0·62	2·07
34	Tophouse	10·86	23	1·65	4·73
35	Hanmer Springs	5·30	18	1·11	3·55
36	Highfield, Waiau	1·97	10	0·46	2·97
37	Gore Bay	1·61	7	0·76	2·41
38	Christchurch	0·99	11	0·51	2·17
39	Timaru	1·78	11	0·96	2·17
40	Lambrook Station, Fairlie	2·32	8	0·94	2·34
41	Benmore Station, Clearburn	3·93	15	0·98	2·66
42	Oamaru	2·04	18	0·59	2·04
43	Queenstown	7·97	20	1·46	2·75
44	Clyde	3·30	15	0·95	1·77
45	Dunedin	5·71	21	1·46	3·33
46	Wendon	5·08	18	0·80	3·15
47	Gore	3·99	21	0·59	3·08
48	Invercargill	5·04	21	1·05	3·93
49	Puysegur Point	12·11	30	1·24	7·10
50	Half-moon Bay	9·47	27	1·66	4·34

Edward Kidson, Director of Meteorological Services, Wellington, 6/2/31.

PERENNIAL RYE-GRASS SEED CERTIFICATION.

AREAS INSPECTED AND PASSED IN FIELD, SEASON 1930-31.

LISTED below are the areas of perennial rye-grass inspected and passed in the field this season. The second and third acreage columns record the acreage passed as suitable for the production of permanent-pasture seed. There is, however, an essential difference between the two. The second column records areas, five years old or over, which are in the meantime passed as permanent pasture but which may be passed subsequently as Mother Seed areas, provided the sample-trial report on the seed harvested warrants such action. In the third acreage column are listed areas under five years old and which are therefore not eligible as Mother Seed areas. The final column refers to areas not previously harvested for seed.

Farmers or others concerned who are not acquainted with the different classes are advised to inquire from the Field Superintendent of the Department of Agriculture for their district.

LIST OF RYE-GRASS AREAS PASSED FIELD INSPECTION.

Name.	Address.	Mother Seed Areas.	Permanent Pasture Areas eligible for Reclassification as Mother Seed Areas.	Permanent Pasture Areas not eligible for Reclassification.	First Harvest Seed Areas.
<i>Poverty Bay.</i>					
		Acres.	Acres.	Acres.	
Adair, H. ..	Manutuke ..	..	30	..	..
Anderson, John ..	Waerengaahika ..	..	42	..	..
Atkins, J. ..	Patutahi ..	10	6	..	..
Baird, W. ..	Bushmere ..	94	5	6	..
Barber, W. E. ..	Hexton ..	..	5	..	..
Bell, H. ..	Hexton ..	..	4	..	..
Bell, R. M. ..	Matawhero ..	..	14	..	..
Bolton, V. S. ..	Waerengaahika ..	14	..	..	..
Boyd, J. ..	Manutuke ..	..	20	..	..
Bull, W. C. ..	Te Karaka ..	..	6	..	..
Butler, P. ..	Patutahi ..	..	29	..	..
Cameron, A. J. ..	Waerengaahika ..	..	49	..	..
Cameron, A. J., Es- tate of	Waerengaahika ..	..	32	..	..
Cameron, E. A. ..	Bushmere ..	..	8	..	..
Cameron, R. J. ..	Mangapapa ..	..	21	..	..
Campbell Bros. ..	Hexton ..	..	31	..	..
Candy, J. J. ..	Waerengaahika ..	..	9	..	..
Cooper, H. ..	Patutahi ..	..	14	..	..
Doulton, J. E. ..	Manutuke ..	9	..	..	..
Ferris, H. K. ..	Wainui ..	..	18	..	..
Gordon Bros. ..	Wangapapa ..	..	26	..	..
Gray's Estate ..	Hexton ..	..	42	..	..
Habgood, F. ..	Patutahi ..	22	34	..	..
Hair Bros. ..	Patutahi ..	..	125	..	..
Hamon, Mrs. H. ..	Waerengaahika ..	28	20	..	..
Herbert, J. T. ..	Bushmere ..	..	7	..	2
Hunt, J. ..	Hexton ..	12	16	..	..
Hunt, J. ..	Gordon's Lane ..	..	42	..	..
Irwin, F. A. ..	Patutahi ..	..	22	..	..
Jones, T. R. ..	Ormond ..	9	..	..	..
Judd, A. J. ..	Patutahi ..	..	30	..	..
Judd, A. R. and C. P.	Patutahi ..	..	17	13	..
Kent, A. ..	Matawhero ..	..	10	..	..
Kent, H. ..	Makaraka ..	..	12	..	..

LIST OF RYE-GRASS AREAS PASSED FIELD INSPECTION—*continued*.

Name.	Address.	Mother Seed Areas.	Permanent Pasture Areas eligible for Reclassification as Mother Seed Areas.	Permanent Pasture Areas not eligible for Reclassification.	First Harvest Seed Areas.
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Poverty Bay—continued.

		Acres.	Acres.	Acres.	Acres.
Knight, L. A. ..	Repongaere ..	..	17	..	..
Miller, R. C. and H. R.	Ormond ..	..	15	..	..
Mills, D. ..	Makauri ..	..	16	..	..
Moore, H. ..	Makaraka ..	..	5	..	..
Moore, R. H. ..	Waerengaahika ..	..	10	..	..
Mullan, B. P. ..	Waerengaahika ..	10	..	..	..
Murphy, M. H. ..	Manutuke ..	..	10	..	..
Paulson, L. ..	Waerengaahika ..	..	11	..	..
Pohata, M. ..	Manutuke ..	..	5	..	..
Read, F. ..	Makauri ..	..	50	..	..
Reynolds, G. M. ..	Ormond ..	..	18	18	..
Roche, J. ..	Makauri ..	8	..	..	..
Scott, Mrs. C. ..	Makauri ..	6	..	..	..
Scott, G. ..	Waipaoa ..	..	40	..	..
Smith, G. V. ..	Patutahi ..	..	..	10	8
Symes, H. ..	Nuhaka ..	..	65	..	..
Taylor, J. ..	Ormond ..	15	..	..	..
Teitjen, C. ..	Waerengaahika ..	..	98	..	6
Tredray, F. H. ..	Patutahi ..	..	5	..	..
Tulloch, H. R. ..	Te Karaka ..	..	14	..	..
Turnbull, A. J. ..	Makauri ..	..	10	10	..
Whitlock, J. ..	Makauri ..	..	16	..	..
Wilson, G. ..	Bushmere ..	..	16	..	..

Hawke's Bay.

Anderson, F. W. ..	Twyford ..	2	2	..	..
Agnew, J. ..	Mangateretere ..	..	4	20	..
Allen, A. W. ..	Tomoana ..	..	..	..	69
Anderson, C. ..	Mangateretere ..	..	8	..	..
Ashworth and Gavin	Pakowhai ..	..	14	..	..
Atkins, A. P. ..	Raupare ..	..	10	..	..
Beatson, G. D. ..	Hastings ..	..	55	..	..
Bolt, F. P. ..	Hastings ..	..	6	..	..
Bone, C. ..	Box 236, Hastings	..	19	..	..
Boyle, D. J. ..	Havelock ..	..	..	..	12
Bridgman, J. ..	Mahora ..	25	25	..	..
Bridgman, S. G. ..	Haumoana ..	16	22	..	..
Burge, A. J. ..	Twyford ..	..	6	..	..
Burge, H. W. ..	Twyford ..	5	..	..	..
Bell, James, Estate of	Turamoe ..	..	47	..	..
Burge, F. ..	Twyford ..	18	17	18	..
Burgess, T. ..	Meeanee ..	61	..	8	..
Burns, H. H. ..	Twyford ..	12	23	..	..
Burns, W. F. M. ..	Richmond Road, Hastings	12	17	..	..
Clarke, H. R. ..	Waiohika ..	25	22	..	..
Connor, F. B. ..	Fernhill ..	..	42	..	..
Couper, E. D. ..	Mangateretere ..	40	..	..	..
Crawford, H. ..	Havelock North ..	..	..	..	13
Currie, D. ..	Twyford ..	..	..	..	7
Currie, T., sen. ..	Twyford ..	6	6	..	7

LIST OF RYE-GRASS AREAS PASSED FIELD INSPECTION--*continued.*

Name.	Address.	Mother Seed Areas.	Permanent Pasture Areas eligible for Reclassification as Mother Seed Areas.	Permanent Pasture Areas not eligible for Reclassification.	First Harvest Seed Areas.
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Hawke's Bay—continued.

		Acres.	Acres.	Acres.	Acres.
Drummond, P. ..	P.B., Napier ..	..	35	..	..
Elliot, D. H. ..	Haumoana ..	..	6	..	..
Fernie, D. ..	Pakowhai ..	..	110	..	..
Field, F. ..	Havelock North ..	..	8	..	..
Frogley, R. ..	Mangateretere ..	..	..	..	10
Frost, G. ..	Twyford ..	11	..	..	..
Gilbertson, D. W. ..	Havelock North ..	..	3	..	..
Goodrick, C. F. ..	Mangateretere ..	..	13	..	..
Gregory, R. ..	Clive ..	..	18	..	..
Gunn, G. ..	Fernhill ..	..	8	..	..
Haldane, C. ..	Raureka ..	..	26	..	..
Hansen, B. ..	Meeanee ..	..	16	..	..
Harris, J. H. ..	Hastings ..	9	..	..	..
Harris, L. E. ..	Box 348, Napier ..	..	57	..	..
Heard, F. ..	Box 208, Hastings ..	..	26	..	..
Heeney, Mrs. M. ..	Mahora ..	23	9	..	17
Heeney, T. P. ..	Mahora ..	..	20	..	..
Heeney, T. ..	Karamu ..	..	..	..	9
Herbert, H. L. ..	Mahora South ..	..	4	..	..
Herbison, J. ..	Pukahu ..	..	20	..	..
Heynes, W. ..	Clive ..	..	54	..	..
Hill, A. E. ..	Mahora ..	..	10	29	22
Jones, H. S. ..	Mahora ..	..	8	..	..
Klingender, G. W. ..	Meeanee ..	..	26	..	..
Knowles, W. C. ..	Pakowhai ..	..	8	..	..
Kyle, T. ..	Southland Road ..	..	4	..	..
Lascelles, P. W. ..	Mangateretere ..	25	20	..	20
Lean, C. ..	Pukahu ..	..	9	..	..
Lister, H. H. ..	Clive ..	..	14	..	..
Lloyd, J. H. ..	Mangateretere ..	..	46	..	..
MacDonald Bros. ..	Havelock North ..	5	..	5	12
MacDonald, James ..	Meeanee ..	104	..	..	..
McKay, A. C. ..	Mahora ..	..	20	..	10
Manson, A. ..	Twyford ..	..	6	..	..
Marshall, J. ..	Mecanee ..	..	22	..	..
Masters, A. J. ..	Twyford ..	29	..	..	..
Masters, L. ..	Twyford ..	..	2	..	..
Marshall, Mrs. E. M. ..	Pakowhai Road ..	15	..	..	..
Milne, C. W. ..	Mangateretere ..	7	3	..	..
Mission Station ..	Greenmeadows ..	..	11	..	..
Morrin, T. V. ..	Hastings ..	..	7	..	..
Murphy, P. B. ..	Mahora ..	2	4	..	..
McGaffin, Mrs. M. ..	P.B., Havelock North ..	..	22	..	..
McKenzie, M. ..	P.O., Taradale ..	..	9	..	..
McKenzie, W. E. A. ..	Pukahu ..	..	12	..	..
McKeesick, W. ..	Haumoana ..	31	..	..	..
McLean, A., Estate of ..	Twyford ..	28	11	..	..
McLeod, D. E. ..	Raupare ..	..	50	..	..
McLeod, W. ..	Pakipaki ..	..	..	8	..
McLernon, P. ..	Karamu ..	..	8	..	6
McNab, J. A., jun. ..	Twyford ..	5	..	5	..
McNab, J., sen. ..	Twyford ..	3	..	..	..
Neagle, P. P. ..	Meeanee ..	..	30	..	..

LIST OF RYE-GRASS AREAS PASSED FIELD INSPECTION—*continued.*

Name.	Address.	Mother Seed Areas.	Permanent Pasture Areas eligible for Reclassification as Mother Seed Areas.	Permanent Pasture Areas not eligible for Reclassification.	First Harvest Seed Areas.
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Hawke's Bay—continued.

		Acres.	Acres.	Acres.	Acres.
Nelson, E. M. ..	Mangateretere ..	..	80	..	..
Nichol, P. G. ..	Twyford ..	..	7	..	..
Nikera, W. H. ..	Waipatu ..	..	20	..	..
O'Neill's Estate ..	Hastings ..	..	53	..	..
Taha Otene ..	Tomoana ..	23	..	..	..
Parsons, P. ..	Meeanee ..	28	71	..	..
Person, G. ..	Twyford ..	..	..	7	..
Pickering and Hackett	Box 47, Napier ..	..	8	..	..
Pimley, F. ..	Mahora ..	..	..	..	8
Pulford's Estate ..	Clive ..	..	7	..	..
Ramsay Bros. ..	Haumoana ..	..	20	..	..
Rathie, J. J. ..	Clive ..	..	..	8	..
Rosser, C., and Son	Pakipaki ..	54	..	..	..
Selby, F. C. ..	Karamu Settlement ..	23	..	..	..
Simson, I. L. ..	Pakowhai ..	..	10	..	..
Simson, I. L. ..	Tomoana ..	40	7	..	..
Smith, E. ..	Twyford ..	3	..	10	..
Speers, A. ..	Pakipaki ..	..	10	..	..
Speers, G. J. ..	Pakipaki ..	10	..	..	..
Starnes, Mrs. M. A.	Haumoana ..	..	13	..	..
Stewart, H. N. ..	Haumoana ..	71	12	..	..
Stone, W. R. ..	Raupare ..	13	..	..	..
Struthers, A. ..	Longlands ..	5	21	..	..
Struthers, J. ..	Pukahu ..	7	..	..	..
Struthers, W. ..	Raureka ..	..	15	..	..
Sweeney, L. ..	Mahora ..	..	..	15	..
Symes, A. F. M. ..	Longland ..	..	100	30	..
Tait, T. ..	Twyford ..	..	20	..	..
Tattersall, C. E. ..	Pakowhai ..	..	48	..	20
Teschmacher, S. ..	Mangatahi ..	..	20	..	..
Thompson, C. H. ..	Twyford ..	..	9	6	..
Thompson, D. P. H.	Twyford ..	..	9	..	..
Thompson, J. H. and G.	Mangateretere ..	..	24	..	..
Tong, F. G. ..	Puketapu ..	..	16	..	..
Trotter, R. ..	Hastings ..	..	12	..	..
Tucker, W. ..	Whakatu ..	..	25	..	..
Vance, L. J. ..	Havelock North ..	..	9	..	..
Wall, E. ..	Mahora South ..	..	4	6	..
Wall, W. J. ..	Karamu ..	..	27	..	..
Walters, W. H. ..	East Clive ..	..	3	..	..
Ward, P. C. ..	Otane ..	..	15	..	..
Wellwood, R. A. ..	Mahora South ..	15	7	..	..
White, T. ..	Tomoana ..	..	12	..	..
White, W. J. ..	Pakowhai ..	..	4	..	..
Whittle, T. ..	Haumoana ..	..	5	..	..
Wilson, F. H. ..	Eskdale ..	..	3	..	..
Winter, J. H. ..	Tutira ..	..	..	..	11
Wright and Wallace	Hastings ..	4	..	..	..
Yule, D. C. ..	Mahora ..	..	26	..	..

LIST OF RYE-GRASS AREAS PASSED FIELD INSPECTION—*continued.*

Name.	Address.	Mother Seed Areas.	Permanent Pasture Areas eligible for Reclassification as Mother Seed Areas.	Permanent Pasture Areas not eligible for Reclassification.	First Harvest Seed Areas.
<i>Manawatu.</i>					
Buchanan, A. R. ..	Kairanga R.D., Palmerston N.	Acres. ..	Acres. ..	Acres. ..	Acres. 24
Buchanan, R. H. ..	Sandon Road, Feilding	..	..	..	23
Collier, F. S. ..	Sanson ..	..	20	..	..
Fagan, H. J. ..	Sanson ..	..	9	..	..
Fagan, J. C. ..	Sanson ..	..	17	..	..
Young, J. ..	Mount Stewart, Awahuri	..	..	..	20
<i>Marlborough.</i>					
Blick, A. ..	Old Renwick Road, Blenheim	..	..	..	4
Nicholas, J. T. ..	Ward ..	..	..	..	10
<i>North Canterbury.</i>					
Beckett, J. ..	Spotswood ..	..	..	..	20
Boag, J. ..	Brookside ..	..	..	..	32
Chamberlain, H. G.	Leeston ..	..	..	..	8
Forbes, G. W. ..	Crystal Brook, Cheviot	..	..	..	18
Galpin, H. ..	Southbridge ..	..	..	..	5
Greenwood, A. C.	Southbridge ..	..	..	..	25
Grigg, G. H. ..	Hororata ..	..	..	..	15
Heslop, J. ..	Southbrook ..	..	..	..	32
Nairn, G. ..	Lakeside ..	..	..	..	11
Stevenson, T. ..	Spotswood ..	..	..	..	16
Sunckell, A. J. ..	Waiau ..	..	..	..	5
Wyllie's Estate ..	Southbridge ..	..	..	..	28
<i>Mid-Canterbury.</i>					
Bruce, A. P. ..	Pendarves, Ashburton	..	..	..	12
MacKay, T., Estate of	Willowby ..	..	..	..	2
Nicholl, E. F. ..	Box 93, Ashburton	..	..	..	15
Robinson, R. D. ..	Effiefton R.D., Ashburton	..	..	..	15
Wilkinson, H. R. ..	Chertsey, Ashburton	..	..	..	18
<i>South Canterbury.</i>					
Campbell, R. and P.	Kingsdown R.D.	..	..	..	17
Fenwick, A. ..	Sutherlands ..	..	..	..	13
Grant, A. ..	Waimate ..	..	..	..	19
Gray, R. ..	St. Andrews ..	..	..	..	5
Muff Bros. ..	Orari ..	..	..	..	2
O'Hara, J. C. ..	Glenavy ..	..	..	..	6
Pearse, A. J. ..	Morven ..	..	..	..	24
Taverner, C. ..	Temuka ..	..	..	..	2

LIST OF RYE-GRASS AREAS PASSED FIELD INSPECTION—*continued.*

Name.	Address.	Mother Seed Areas.	Permanent Pasture Areas eligible for Reclassification as Mother Seed Areas.	Permanent Pasture Areas not eligible for Reclassification.	First Harvest Seed Areas.
<i>North Otago.</i>					
Newlands, G. ..	Kauroo Hill R.D., Oamaru	Acres. ..	Acres. ..	Acres. ..	Acres. 7
<i>Central Otago.</i>					
Hunt, J. S. ..	Maungawera ..	..	..	34	..
<i>Otago.</i>					
Christie, J., and Sons	Warepa ..	..	..	..	7
Clement, E. A. ..	Pomahaka ..	..	..	..	20
Findlayson, P. ..	Crookston ..	..	..	..	8
Hayman, E. W. ..	Tuapeka Mouth ..	..	..	..	10
Lawrence, A. ..	Taumata ..	..	..	..	13
McDonald, D. ..	Carterhope Estate, Balclutha	..	..	..	225
McKenzie, W. J. ..	Waikoikoi ..	..	..	..	10
Murney, E. H. ..	Tapanui ..	..	..	..	18
Sim, A. W. ..	Heriot ..	..	..	..	9
Sim, S. ..	Heriot ..	..	..	..	10
Walker, W. ..	Heriot ..	..	..	..	10
Waters, J. ..	Taumata ..	..	..	..	4
<i>Southland.</i>					
Barron, W. ..	Morton Mains ..	..	..	..	8
McKenzie, D. ..	Otapiri R.D., Winton	..	..	..	7
Martin, R. ..	Otama ..	..	..	..	20
Mortimer, W., jun.	Waipounamu ..	..	..	..	9
Telfer, T. ..	Brydone ..	..	..	..	19
Totals ..		1,074	3,092	279	1,197

—J. W. Hadfield, Agronomist, Plant Research Station.

FORTHCOMING AGRICULTURAL SHOWS.

THE following show-dates have been notified by agricultural and pastoral associations:—

Marton A. and P. Association: Marton, 25th February.
 Auckland A. and P. Association: Auckland, 26th, 27th, and 28th February.
 Rangitikei A. and P. Association: Taihape, 28th February.
 Katikati A. and P. Association: Katikati, 3rd March.
 Taranaki Agricultural Association: New Plymouth, 4th and 5th March.
 Waikato Central Agricultural Association: Cambridge, 4th and 5th March.
 Morrinsville A. and P. Society: Morrinsville, 11th March.
 Mayfield A. and P. Association: Mayfield, 14th March.
 Hawke's Bay A. and P. Society: Tomoana (Autumn Show), 18th March.
 Methven A. and P. Association: Methven, 28th March.
 Oxford A. and P. Association: Oxford, 2nd April.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FOAL NOT SUCKING ITS MOTHER.

"CLYDESDALE," Pomahaka :—

I have a foal which has no notion of sucking its mother, also will not suck one's finger or a soft teat on a bottle. The foal appears strong and healthy in every way. Can you suggest a way of teaching it to suck? At present I am pouring its mother's milk down its throat from a bottle, and have cut the cord under its tongue. It will rub its nose against its mother's udder, which is as much as it will do towards attempting to drink. Can you tell me the cause of foals not attempting to suck, as several in the district are like that this year?

The Live-stock Division :—

If the foal is healthy and of sound constitution, and its mouth normal, there should not be much difficulty in getting it to suck the mare, since it naturally possesses a powerful instinct to do so. In cases of difficulty a good deal of patience would be required. As the foal "muzzles" the udder, the teat should be directed into its mouth and a little of the milk drawn into it each time. When the foal would not take sufficient at a meal, the mare could be milked and the foal given it from an ordinary nursing-bottle with a large nipple. Until the foal commenced to carry on on its own account the process would require to be repeated about every three hours. We do not think cutting the frænum would be of any benefit, but would only tend to make the mouth sore.

FIG-CULTURE.

"SUBSCRIBER," Havelock North :—

I am growing figs with some success. Can you tell me whether we should allow any of the suckers which spring up round the main stem to fruit? They frequently bear fruit. Also, what is the best manure for these trees?

The Horticulture Division :—

When the fruit is to be used in a fresh state the fig-tree is generally made to branch low down, much like a bush-grown apple-tree, to facilitate picking; but as a rule suckers should not be allowed to develop. If they do they are usually barren themselves and rob the tree. As long as the suckers from your trees are bearing fruit, however, they may be allowed to remain. The manures suitable depend on the land and the condition of the trees. On good land, reasonably moist, no manure should be required until the trees come into bearing, when green cover-crops or farmyard manure and fertilizers will be beneficial. The fig-tree is also partial to dressings of lime.

DEHORNING COWS.

H. L. McMILLAN, Ongarue :—

I intend to have my cows dehorned shortly, and would like advice on the matter. Would dehorning have any effect on cows that are in calf?

The Live-stock Division :—

It really does not matter when the dehorning operation is done, but it is preferable to do it in the autumn or at any time when the weather is coolest and no flies about. In hot weather one is liable to get excessive bleeding, and flies are troublesome. We have not known in-calf cows to suffer any ill effect from the operation.

CALVES IN TROUBLE.

"SUBSCRIBER," Kohuratahi:—

I have two strong well-grown calves, five months old, which have recently started panting heavily immediately after pasturing. Their tongues protrude and are swollen, eyes quite normal, but noses dry, and no sign of bloat. The pasture is quite clean, but has an abundance of white clover. I have given them a soda drench, which does not seem to benefit them. I would be very pleased for advice.

The Live-stock Division:—

It is rather difficult to diagnose the trouble from the symptoms as described. Although no mention is made of coughing, there is more than a possibility that the calves are affected with lung-worms. When these parasites infest the bronchial tubes and lungs the breathing is hurried, the tongue protrudes from the mouth, and affected animals have a dry husky cough—hence the name "husk" given to the trouble. If a cough is present it is advisable to dose the animals with turpentine and oil, repeated every few weeks. On the other hand, it is possible the calves are merely suffering from an overloaded stomach, from engorgement due to the clover pasture. As no bloat or tympany is present, the animals do not require any medicinal treatment. The calves may be given a dose of oil and changed to a pasture containing less white clover.

INTERNATIONAL YEAR-BOOK OF AGRICULTURAL STATISTICS, 1929-30.

THE 1929-30 edition of the International Year-book of Agricultural Statistics, published by the International Institute of Agriculture, Rome, has been issued.

In the first part of the volume, of about 800 pages, are classified the figures for area and population in the years nearest to 1913 and 1929 for 220 countries. The presentation of these figures throws light upon the world situation from the geographical, political, and demographical points of view during both the pre-war and post-war periods. The second part is composed of a series of tables comprising for nearly fifty countries the available data concerning the uses for which the total area is employed, the apportionment of cultivated areas between the different crops, agricultural production, and numbers of the different kinds of live-stock and the products derived from them. In the tables constituting the third part have been indicated for nearly forty agricultural products the area, production, and yield per acre in each country during the last five years of the pre-war period and during each of the years from 1926 to 1929.

For each kind of live-stock all available figures in the different countries have been grouped for the years 1913 and 1925 to 1929. A large part of the volume is devoted to statistics of the commercial movement of forty-two vegetable products and twelve products of animal origin. The figures published relate to the imports and exports during the calendar years and for the cereals also during the commercial seasons.

The tables of production and commerce not only specify details for each country, but also the totals for the different continents and hemispheres and for the whole world, allowing the formation of a general idea of the changes taking place during the periods under consideration in the area under each crop, quantities harvested, and the commercial movement in each product.

The part devoted to prices contains the weekly quotations of twenty-five agricultural products on the principal world markets for the year 1913, and for the period January, 1926, to June, 1930. In the freights section will be found quotations for the carriage of wheat, maize, and rice on the most important shipping routes. In the section devoted to fertilizers and chemical products useful in agriculture are published statistics of production, trade, and prices for fifteen products. In the rates of exchange section are set out the rates on the New York exchange for the most important currencies.

For the first time there have been introduced into the volume special chapters on the importance and distribution of the agricultural population, the distribution of agricultural holdings according to their size and mode of tenure, and forestry.

ESTIMATED YIELDS OF WHEAT, OATS, AND BARLEY.

THE following estimated average yields per acre of wheat, oats, and barley for the season 1930-31 have been compiled by the Census and Statistics Office from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 9th February :—

District.	Wheat. Bushels per Acre.	Oats. Bushels per Acre.	Barley. Bushels per Acre.
North Island	34.48	38.83	33.96
Nelson	33.00	30.00	31.00
Marlborough	30.09	30.59	34.92
Canterbury	26.21	37.50	28.93
Otago	31.02	41.33	36.60
Southland	36.33	43.84	38.00
Average (estimated) for the Dominion, season 1930-31	27.08	40.10	32.16
Average (actual), for the Dominion, season 1929-30	30.68	44.33	41.42

In accordance with the above estimates, the total yield of wheat for the season 1930-31 should be approximately 6,500,000 bushels, as against an actual yield of 7,239,556 bushels for the season 1929-30.

The percentage of oats threshed for the five seasons ending with 1929-30 averaged 27.41 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 3,540,000 bushels, as against an actual yield of 3,002,288 bushels for the season 1929-30.

The percentage of barley threshed for the five seasons ending with 1929-30 averaged 97.99 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 795,000 bushels, as against an actual yield of 755,007 bushels for the season 1929-30.

FERTILIZER IMPORTATIONS: DECEMBER QUARTER.

FOLLOWING are particulars of importations of fertilizers into New Zealand for the quarter ended 31st December, 1930 :—

Sulphate of Ammonia : United Kingdom, 2,000 tons. *Basic slag* : United Kingdom, 100 tons ; Belgium, 100 tons ; Germany, 1,100 tons. *Guano* : United Kingdom, 10 tons ; Seychelles Island, 2,566 tons. *Rock phosphate* : Ocean Island, 11,335 tons ; Nauru Island, 8,086 tons. *Phosphates (other)* : United Kingdom, 181 tons ; Netherlands, 200 tons ; Morocco, 7,321 tons ; Tunis, 250 tons. *Kainit* : Belgium, 10 tons ; France, 213 tons ; Germany, 55 tons. *Muriate of potash* : France, 5 tons. *Sulphate of potash* : France, 65 tons ; Germany, 163 tons. *Potash (other)* : Belgium, 30 tons ; France, 625 tons ; Germany, 790 tons. *Sulphate of iron* : United States of America, 1 ton. *Manures unenumerated* : United Kingdom, 13 cwt. ; Germany, 1,140 cwt.

Silage and Blowing in Cattle.—A Manawatu farmer last spring was having a considerable amount of trouble and loss through his stock blowing on the young fresh grass. He was holding a considerable amount of silage from the previous season, and as an experiment decided to try and get his cows to take to silage again, although doubtful with the amount of fresh grass available. The cows not only took readily to it, but the trouble with blowing ceased.